INTENSIVE COURSE ON SA/SD/RT METHOD AND PROSA/SA CASE TOOL

TRAINING COURSE:
PROSA/SA/M-USE

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Insoft Oy
P.O.BOX 9
FIN-90101 Oulu, FINLAND

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INTENSIVE COURSE ON SA/SD/RT METHOD AND PROSA/SA CASE TOOL

1. Structured Analysis and Design (SA/SD/RT) method

In SA/SD/RT the application system is modeled with three models completing each others. The environment model consists of context diagram and event list documents. The context diagram determines the boundary between the application and its environment. The event list presents externals events which the application system must generate response to. The behavioural model consists of data flow diagrams, state transition diagrams and minispecifications. The functions of the application system are modeled with data flow diagrams. Data flow diagrams are hierarchical modeling the hierarchical decomposition of the application into functional subunits. State transition diagrams model the control and timing of the application. Minispecifications are used on the lowest hierarchy level of the data flow diagrams to model the behaviour of transformations. The information model uses ER diagrams to define the data entities and their composition and relationships in the application. All model information is stored in data dictionary. Figure 1.1 presents the principle of SA/SD/RT method.

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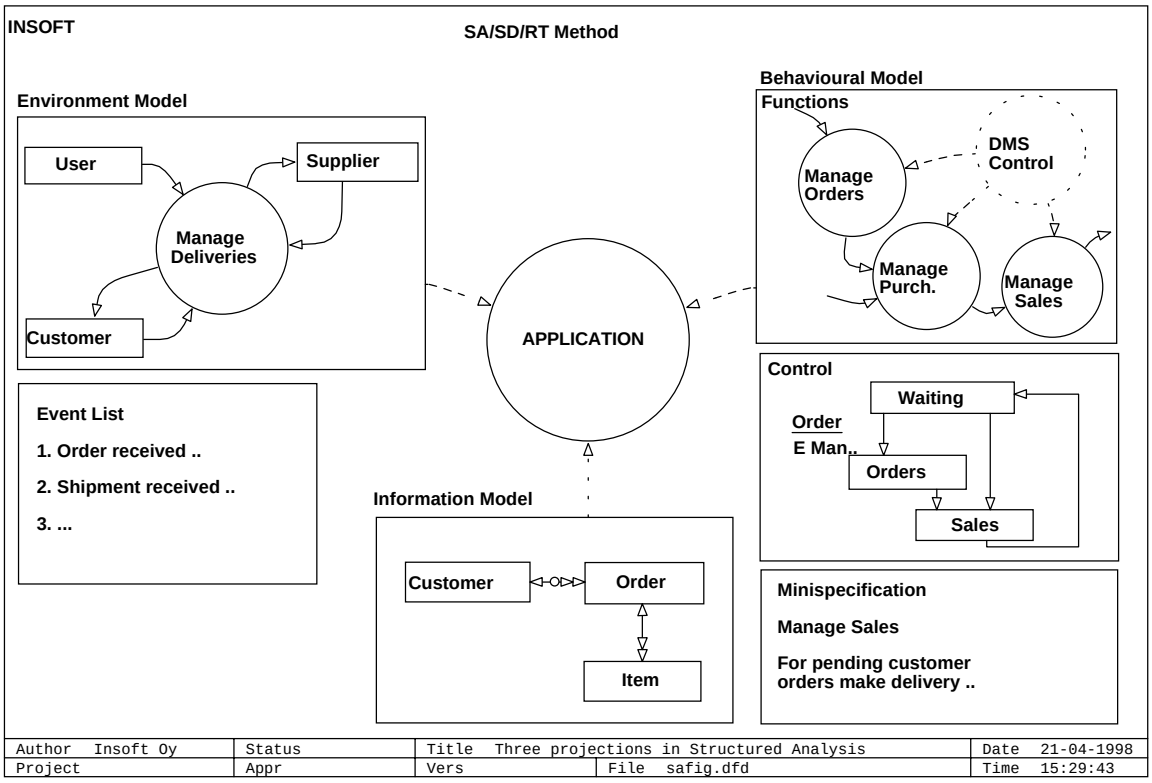

Figure 1.1 Three projections in SA/SD/RT method.

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2. ENVIRONMENT MODEL

2.1 Description of the environment model

The purpose of the environment model is to define exactly the boundary between the application and its external environment. The environment model is presented with two integrated documents: (1) context diagram and (2) event list.

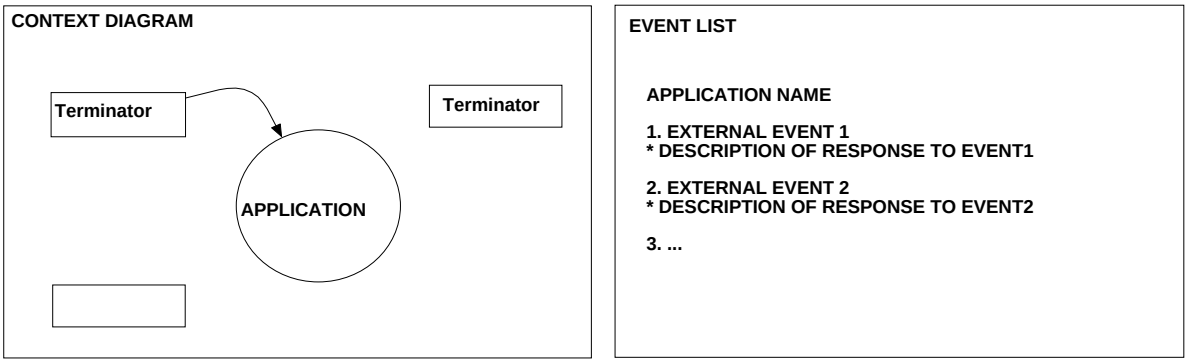

Figure 2.1 Environment model.

2.2 Context diagram

The whole application is modeled in context diagram with a single data transformation. The context diagram is named with the system or application name and context diagram is numbered with number -1. The environment of the application is modeled with terminators. The interaction between the application and its environment is modeled with flows. Figure 2.2 presents the modeling primitives of the context diagram.

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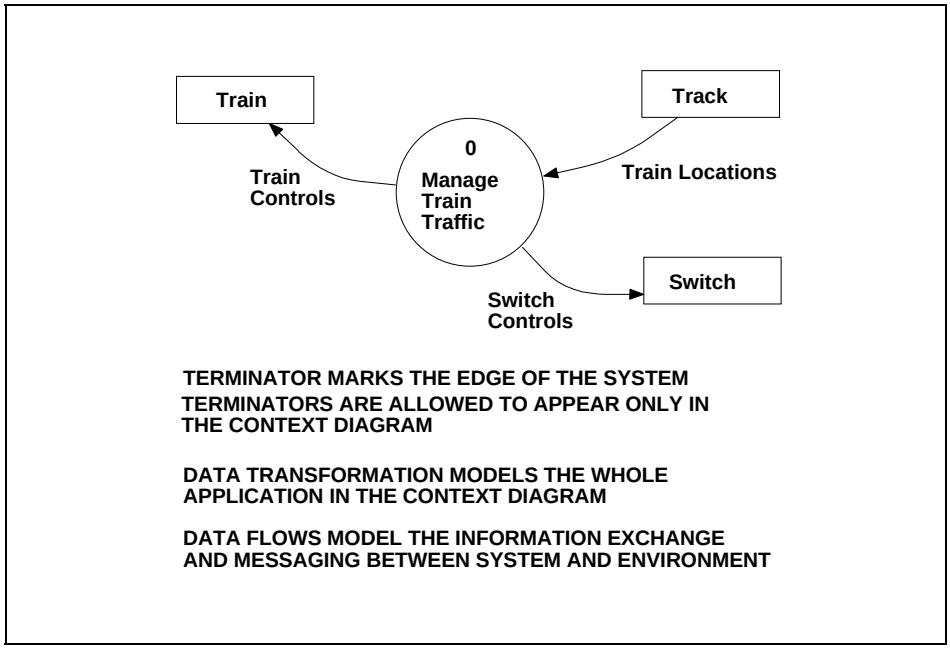

Figure 2.2 Environment model modeling primitives.

2.2.1 Transformation

The data transformation of the context diagram models the whole application. The transformation of the context diagram has number 0 and the name of the transformation is presented in imperative mode <Verb> <Noun>. The first letter of every word is a capital letter.

2.2.2 Terminator

The terminators of the context diagram mark the edge of the system. The terminators model the environment boundary. In practice terminators are objects like User, Motor, Manager. Terminators may also present subsystems of the current system. Use understandable, reusable terminator names like "User", "Sensor". Avoid terminator names like "16-bit A/D converter", "CRT display", "102 key keyboard".

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When selecting terminators it is very important to use general purpose concepts in terminators and to group or package such external objects with similar functionality into one terminator. So e.g. User terminator can contain many kinds of users. Instead of using terminators Robot1, Robot2, Robot3, ... one packaged terminator Robot is much better.

2.2.3 Flows

Flow are used in the context diagram to present the information flow between the system and its environment. The data flows are named so that the name illustrates the contents of the information. SA/SD/RT method supports several data flow types. Data flow types have been presented in Section 5 Behavioural model.

The data flows appearing in the context diagram must have the same abstraction level as the context diagram itself has. This means that it is not according to good modeling practice to present such low abstraction level data flows in the context diagram which can be understood only by knowing already the whole application. E.g. if you are modeling the interaction between "Customer" terminator and "Deliver Products" transformation in the context diagram, the whole interaction is normally modelled with one input flow "Customer data" and one output flow "Delivery data". The detailed data flow contents is defined in Data Dictionary (See Section ? Behavioural model) when the modeling proceeds further.

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2.3 Event list

Event list is a complementary document for the environment model. Event list is a textual document listing external events from the environment to application to which the application must generate response. The notation of the event list is presented in Figure 2.3.

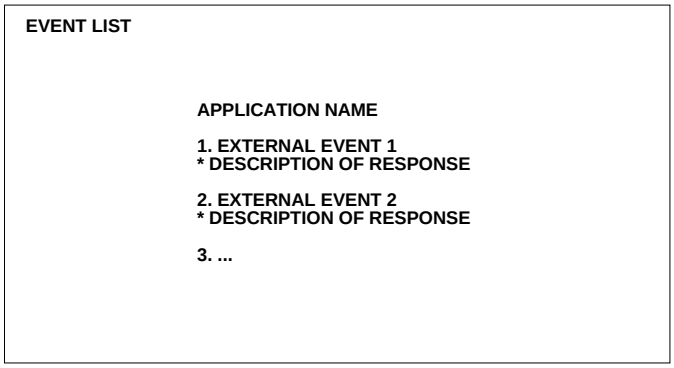

Figure 2.3 Event list.

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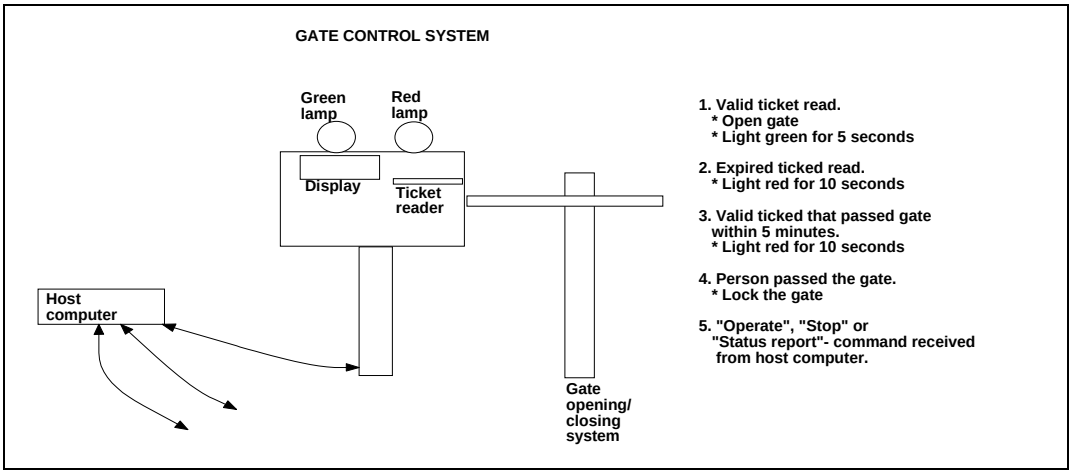
2.4 Example environment model


GATE CONTROL SYSTEM
Green lamp
Red lamp
Display
Ticket reader
Host computer
Gate opening/ closing system
1. Valid ticket read.
* Open gate
* Light green for 5 seconds
2. Expired ticked read.
* Light red for 10 seconds
3. Valid ticked that passed gate within 5 minutes.
* Light red for 10 seconds
4. Person passed the gate.
* Lock the gate
5. "Operate", "Stop" or "Status report"- command received from host computer.

2.4 Skilift system block diagram

Skilift gate control system is a remote controlled system. The host computer controls the gate control system with messages "Operate", "Stop", and "Make Report". The "Operate" message activates the gate for operation, "Stop" message finishes the gate operations and "Make Report" message causes the gate to send a statistics report to the host.

The gate has gate opening/closing system, a ticket reader, a display for presenting messages and green/red lamps for alarms. In normal operation when a person presents a valid ticket, the gate lights green lamp for 5 seconds and opens the gate. If an expired ticket is read, the red lamp is lighted for 10 seconds and the gate remains closed. If the same ticket is presented within 5 minutes from the previous passing, the red lamp is lighted for 10 seconds and the gate remains closed. Immediately when a person has passed the gate, the system will lock the gate again.

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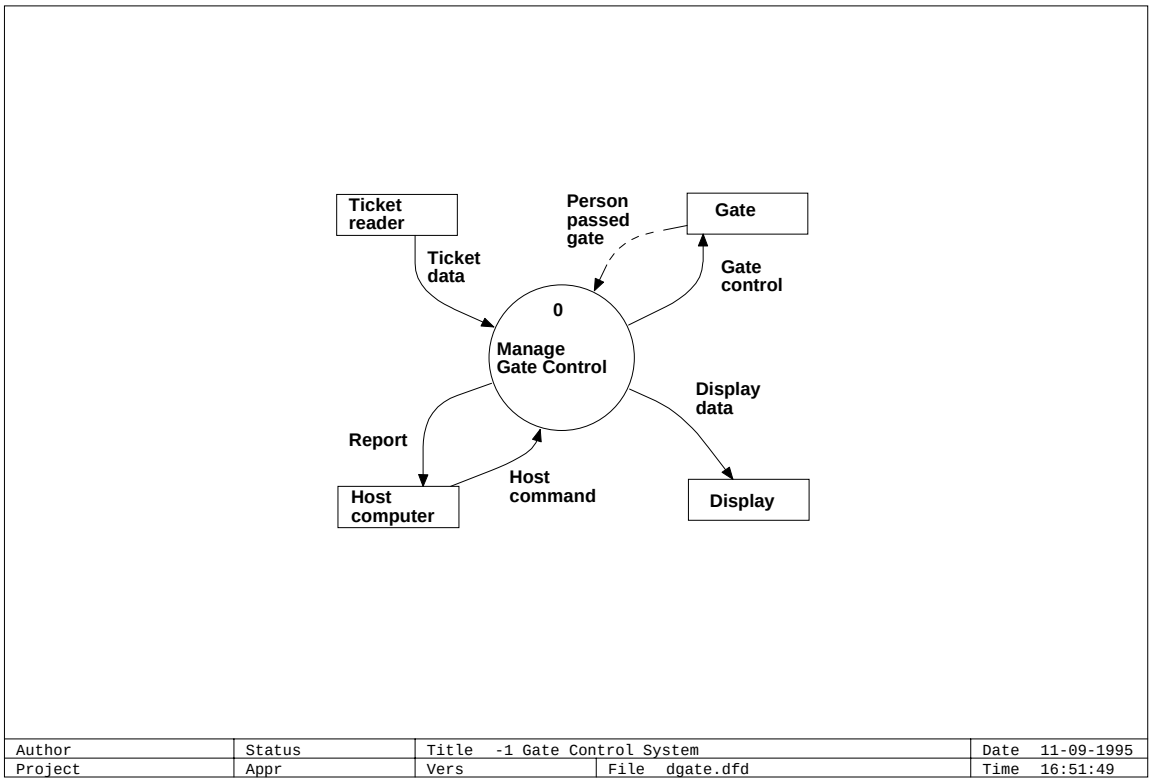

2.5 Gate Control context diagram

Gate Control System
Event list

1. Valid ticket read.
   * Open gate
   * Light green for 5 seconds

2. Expired ticked read.
   * Light red for 10 seconds

3. Valid ticked that passed gate within 5 minutes.
   * Light red for 10 seconds

4. Person passed the gate.
   * Lock the gate

5. "Operate", "Stop" or "Status report"- command received from host computer.

2.6 Gate Control System event list

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3. BEHAVIOURAL MODEL

3.1 Description of the behavioural model

The behavioural model presents the functionality and control of the application. The functionality and the information flow in the application is presented by hierarchically refined data flow diagrams. The hierarchical data flow diagrams present the hierarchical decomposition of the application into functional subunits. Textual minispecifications are used on the lowest hierarchy level to describe the primitive processes. State transition diagrams present the control part and timing of the application.

3.2 Data flow diagram

Data flow diagrams model the functionality of the application. Data transformations present functions or hierarchically decomposed functions in dfd's. Data flows model the information flow between functions. Event flows model messages. Data or event flows starting or ending in the diagram area are interpreted to be external flows originating from the previous hierarchy levels. SA/SD/RT method supports several data flow and event flow types. Data stores and data buffers model information repositories in the model. Control transformation presents the control part of the data flow diagram.

Data flows, event flows and data stores can be further defined in the Data Dictionary.

Data flow diagram names are always inherited from corresponding transformation name on the previous hierarchy level.

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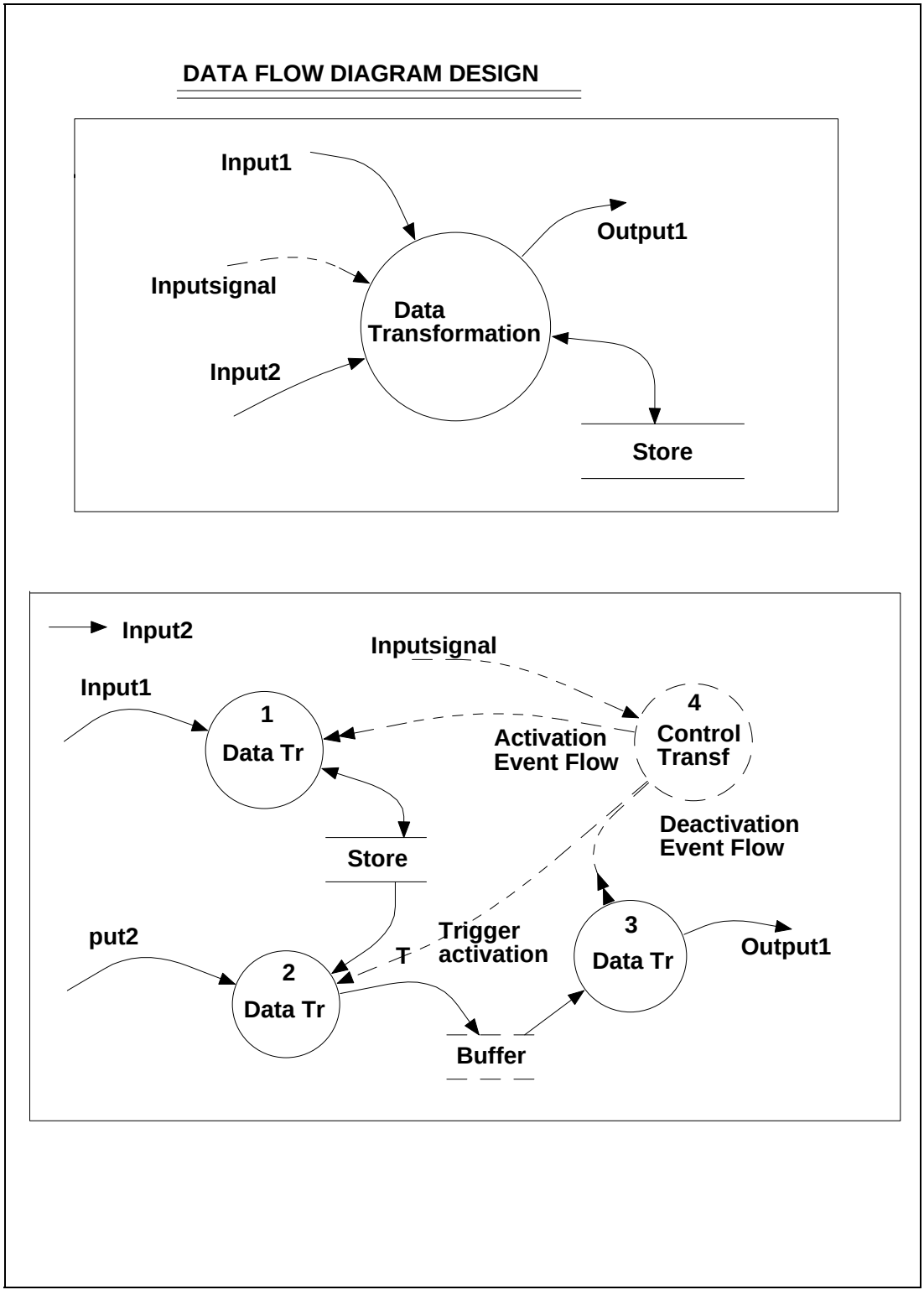

Figure 3.1 Data flow diagram.

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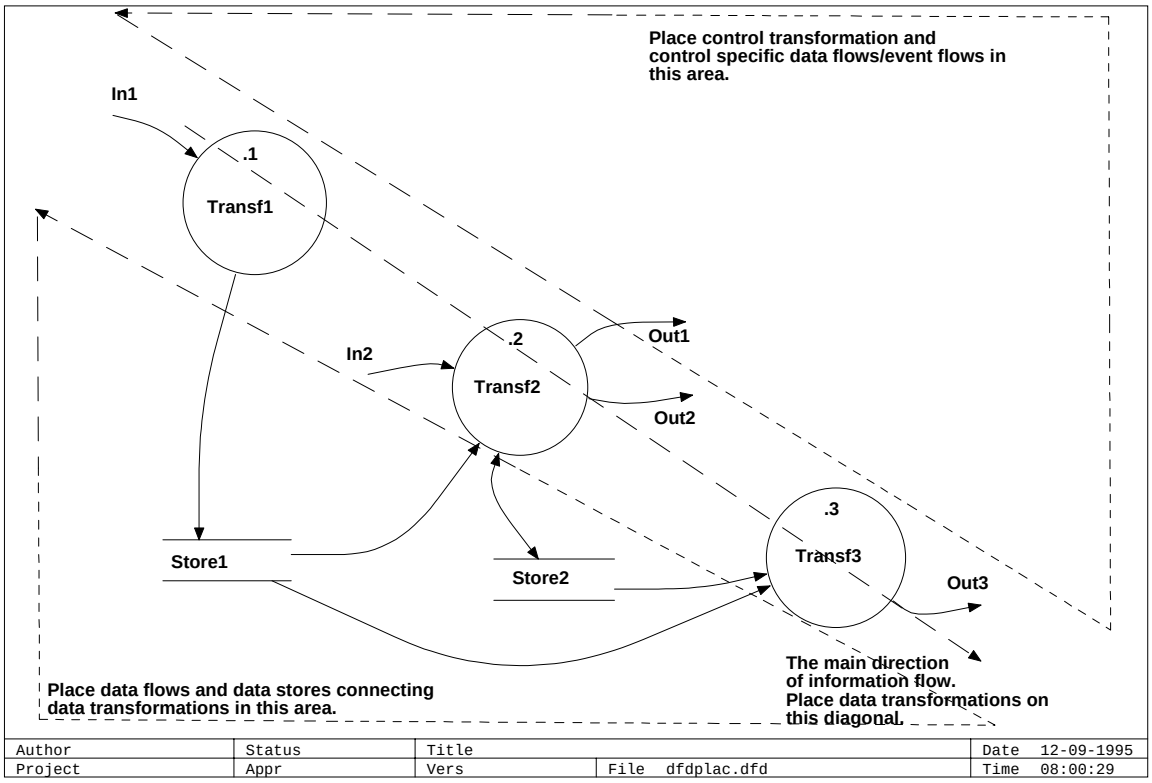

Figure 3.2 Locating modeling symbols in data flow diagram.

3.2.1 Data transformation

Data transformation presents function or hierarchically decomposed function in dfd. Input flows present input parameters and output flows output parameters. A data transformation can be modeled further hierarchically with a new data flow diagram or with a textual minispecification.

Use transformation names that describe well the behaviour of the transformation. The name should be always in form <Verb> <Noun>. Start each word with a capital letter. Good transformation names are e.g. "Read Temperature", "Make Report", "Calculate Position". To achieve the highest possible reusability, number the transformations with running numbers starting .1, .2, .3 inside a model. The actual hierarchy number of each transformation is constructed by combining the model number i.e. number preceding the diagram name and the transformation number. Position transformations so that the main information flow in the model

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goes from up-left to down-right. This kind of positioning policy makes models easy to read and understand.

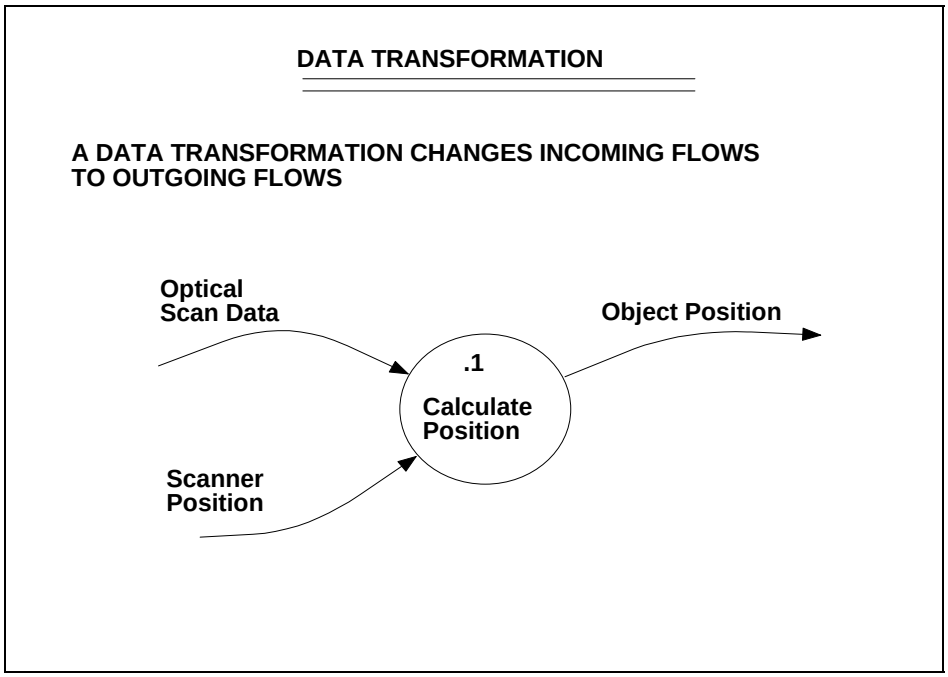

Figure 3.3 Data transformation.

3.2.2 Data flows

Data flows transfer information between SA/SD/RT modeling objects. Data flow may contain a single data element or it may be a packaged bundle flow or a structure of several data components. The abstraction level data flows and corresponding data flow diagram should be in balance i.e. you should not introduce such detailed data flows into the model which are not needed on that detail level yet in the model. Instead you should use information packaging and hide the details in Data Dictionary. For defining complex data structures, see Section Data Dictionary. SA/SD/RT method has three data flow types (1) Discrete data flow, (2) Bidirectional discrete data flow and (3) Continuous data flow.

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Data flows should be named according to the data contents, not according to the data structure.

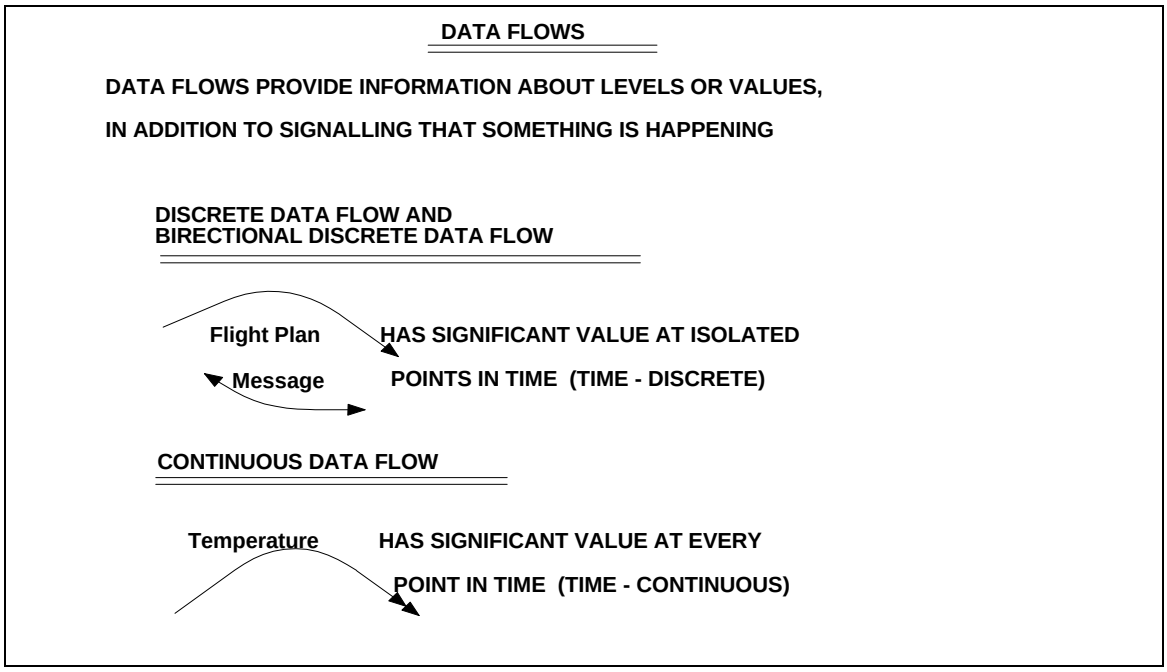
DATA FLOWS
DATA FLOWS PROVIDE INFORMATION ABOUT LEVELS OR VALUES,
IN ADDITION TO SIGNALLING THAT SOMETHING IS HAPPENING
DISCRETE DATA FLOW AND
BIRECTIONAL DISCRETE DATA FLOW
Flight Plan
Message
HAS SIGNIFICANT VALUE AT ISOLATED
POINTS IN TIME (TIME - DISCRETE)
CONTINUOUS DATA FLOW
Temperature
HAS SIGNIFICANT VALUE AT EVERY
POINT IN TIME (TIME - CONTINUOUS)

Figure 3.4 Data flow types.

3.2.3 Control transformation

Control transformation models the control part, the sequencing of the data flow diagram. Control transformation models data transformation activations and deactivations. Control transformation accepts event flows and discrete data flows as inputs and it produces event flows and discrete data flows as outputs. Control transformation presents in the behavioural model the integration between data flow diagrams and state transition diagrams.

A good default naming of control transformation is to put verb "Control" at the beginning of the model name where the control transformation appears. Control transformation is numbered similarly as data transformations.

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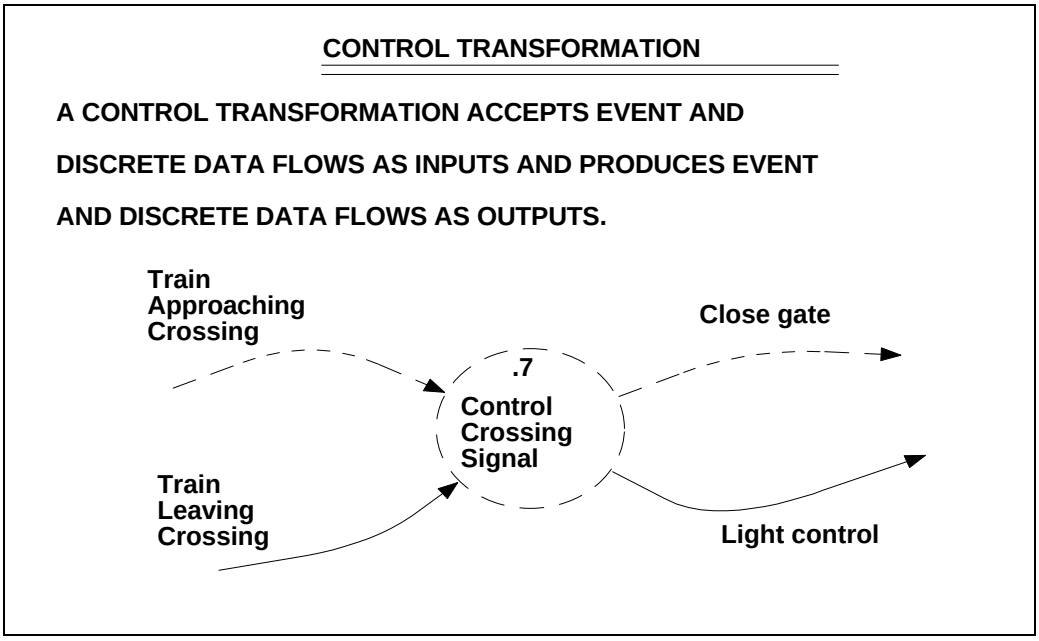

Figure 3.5 Control transformation.

3.2.4 Event flows

Event flows transfer messages between SA/SD/RT modeling objects. Event flow may contain a single message or it may be a bundle or structure of several message components. Message components can be defined in Data Dictionary. For defining message components, see Section Data Dictionary. SA/SD/RT method has three event flow types (1) Signal, (2) Activation and (3) Deactivation.

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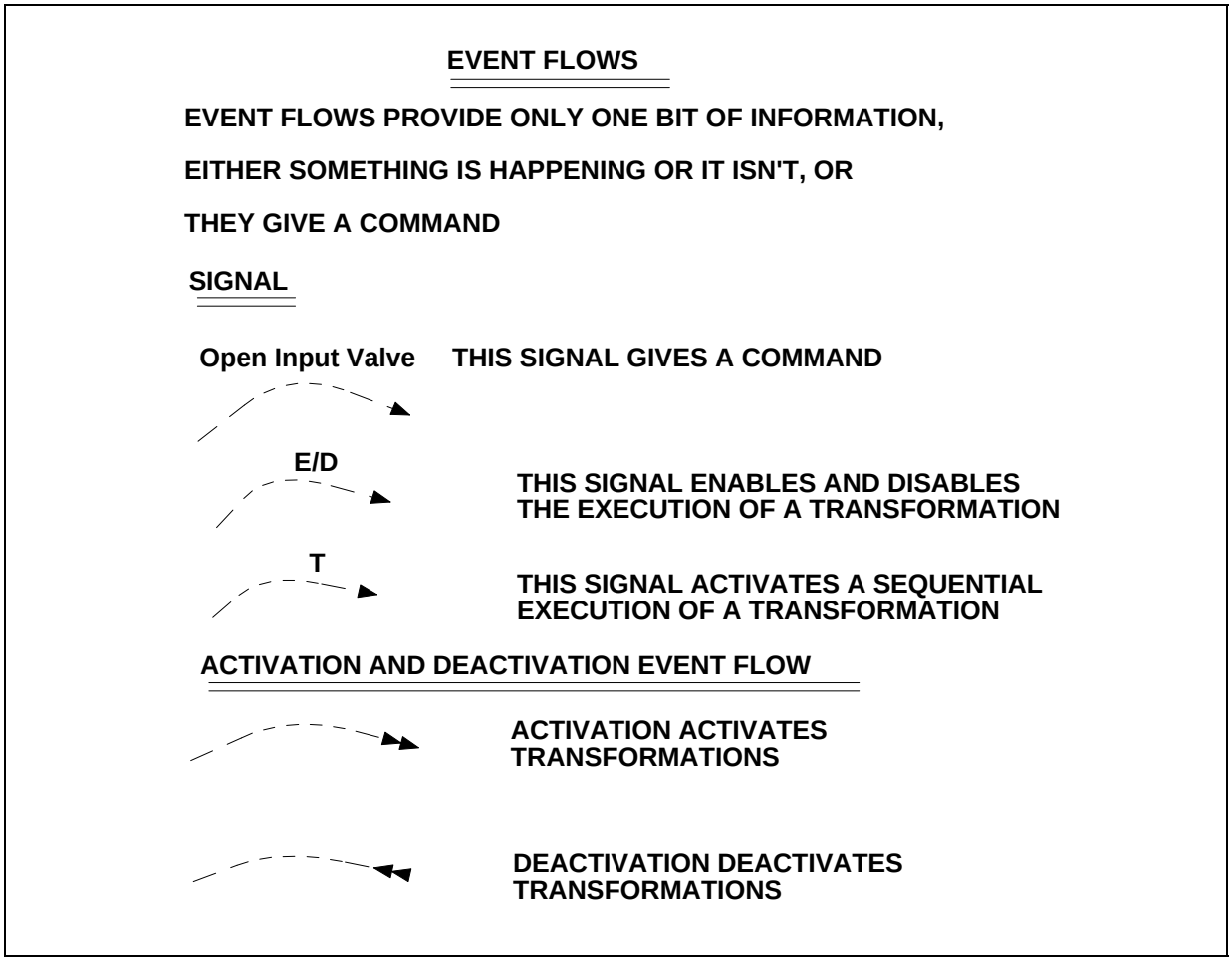

Figure 3.6 Event flow.

3.2.5 Data store

Data store is a repository for data. The scoping rules of the data store in SA/SD model are such that when a certain data has been once specified to be a data store in the model, it must appear as a data store also in all lower hierarchy levels. Data store is passed to lower hierarchy levels by connecting it with the corresponding data transformation.

Data store may contain a single data element or it may be a bundle or structure of several data components. For defining components of a data store, see Section Data Dictionary.

In SA/SD model it is allowed to use also data store components. Then you must name the corresponding data flow with the store

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component name. Data stores should be named according to the data contents, not according to the data structure.

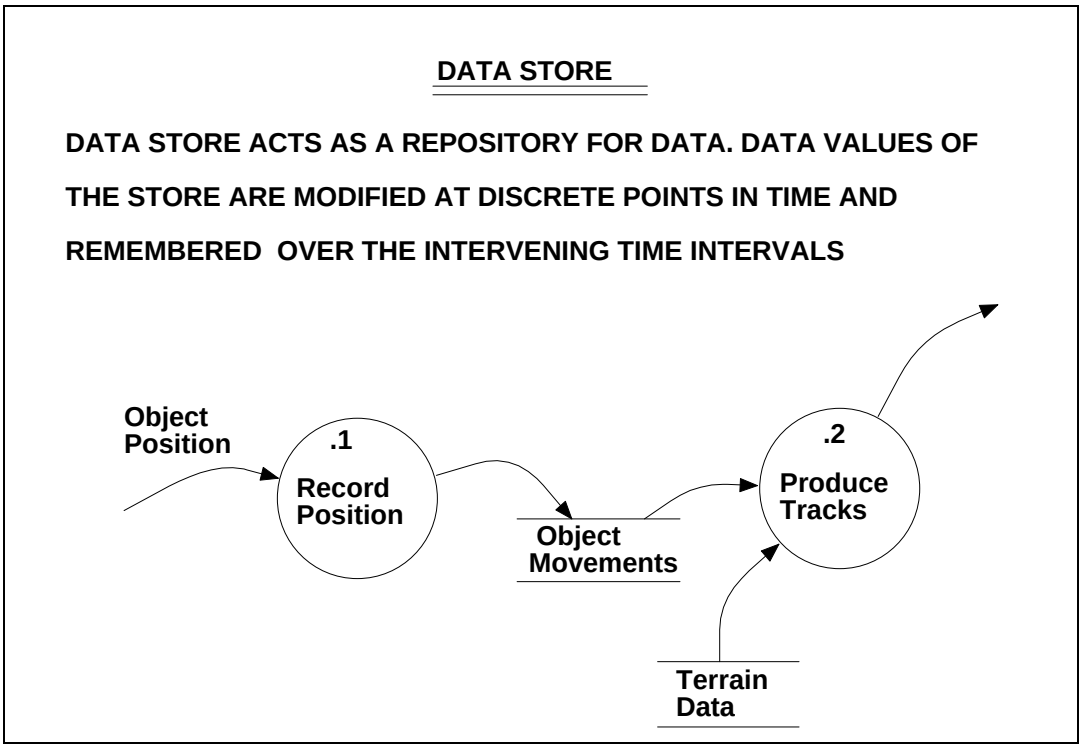
DATA STORE
DATA STORE ACTS AS A REPOSITORY FOR DATA. DATA VALUES OF THE STORE ARE MODIFIED AT DISCRETE POINTS IN TIME AND REMEMBERED OVER THE INTERVENING TIME INTERVALS
Object Position
.1
Record Position
Object Movements
.2
Produce Tracks
Terrain Data

Figure 3.7 Data store.

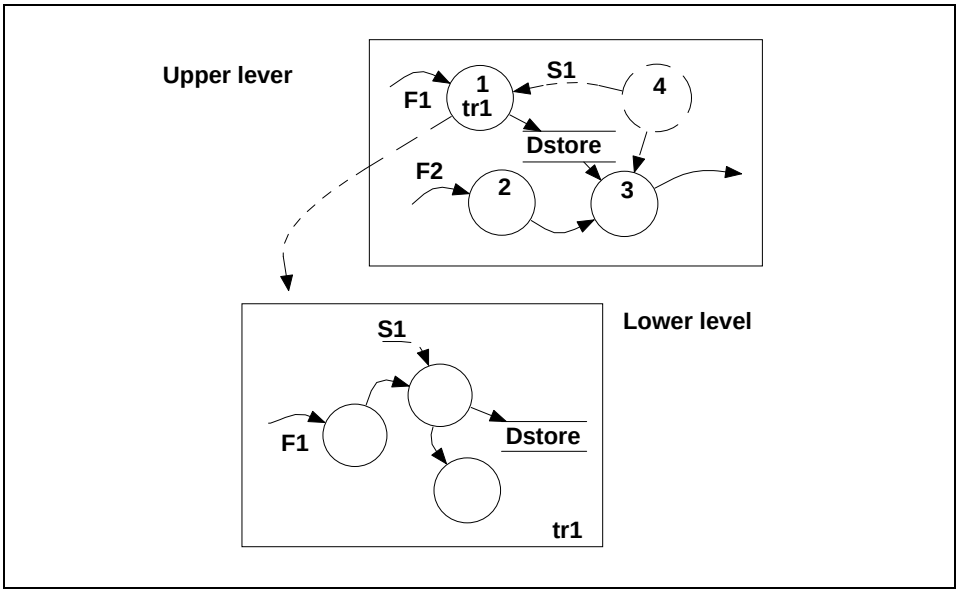

Figure 3.8 Data stores and flows are passed to lower hierarchy levels by connecting them with data transformation.

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3.2.6 Data buffer

Data buffers store message information. Data buffers are normally used to model stack and queue type data storage.

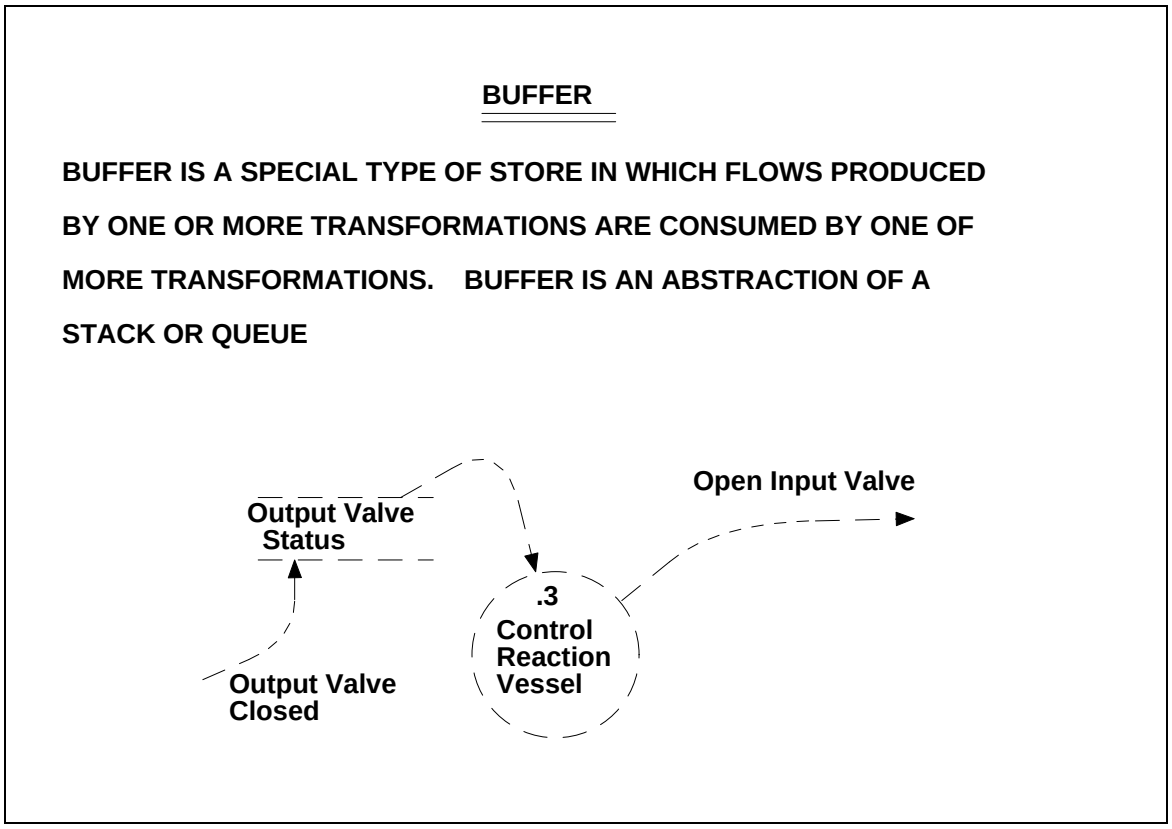
BUFFER
BUFFER IS A SPECIAL TYPE OF STORE IN WHICH FLOWS PRODUCED BY ONE OR MORE TRANSFORMATIONS ARE CONSUMED BY ONE OF MORE TRANSFORMATIONS. BUFFER IS AN ABSTRACTION OF A STACK OR QUEUE
Output Valve Status
Open Input Valve
.3
Control Reaction Vessel
Output Valve Closed

Figure 3.9 Data buffer.

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3.2.7 Example data flow diagram

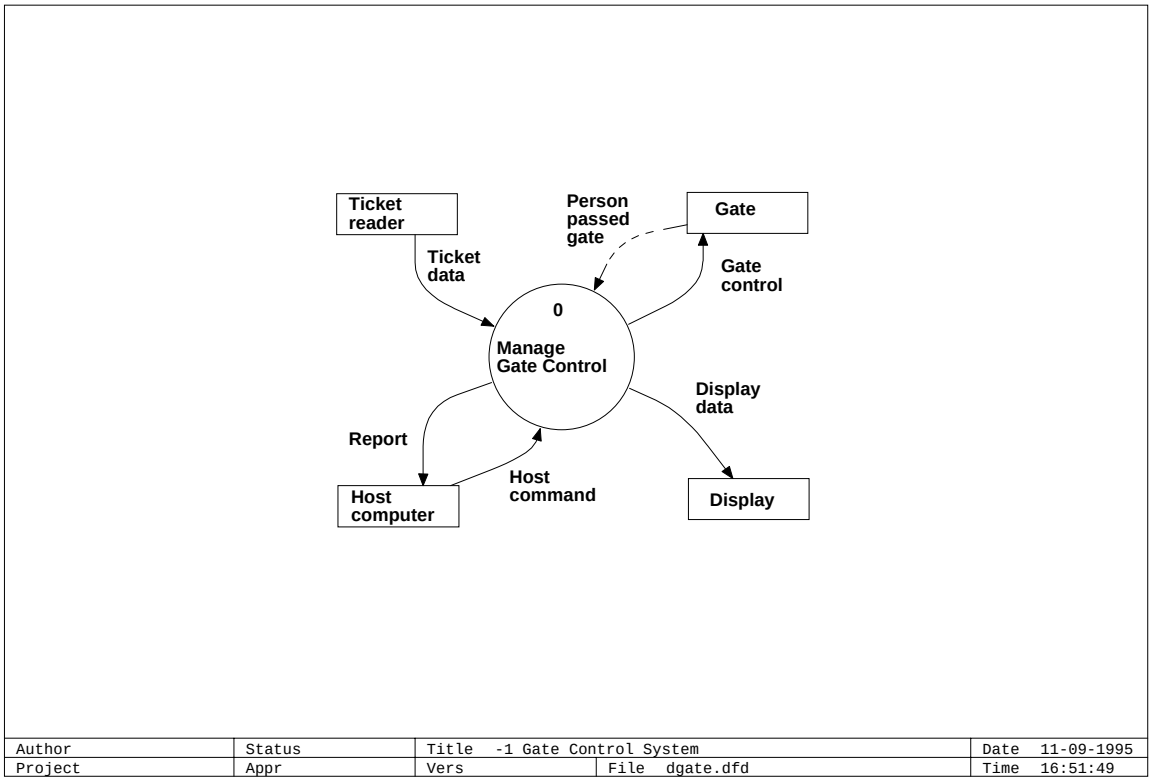

Figure 3.10 Skilift control system context diagram.

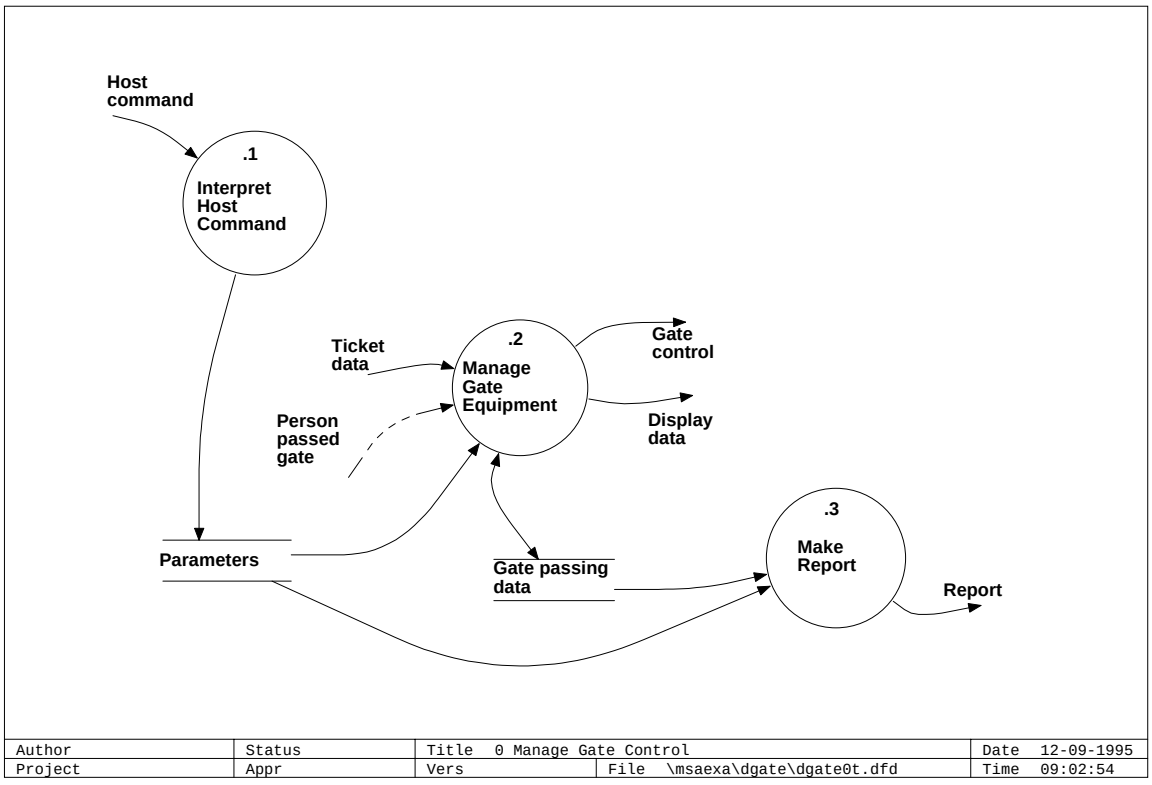

Figure 3.11 The 0-level data flow diagram.

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3.3 System and subsystem modeling

SA/SD/RT method can be used on all modeling abstraction levels from company's business and strategic planning down to module and programming level. In a very large systems the developing can be divided into subsystems where the subsystem is modelled from the context level.

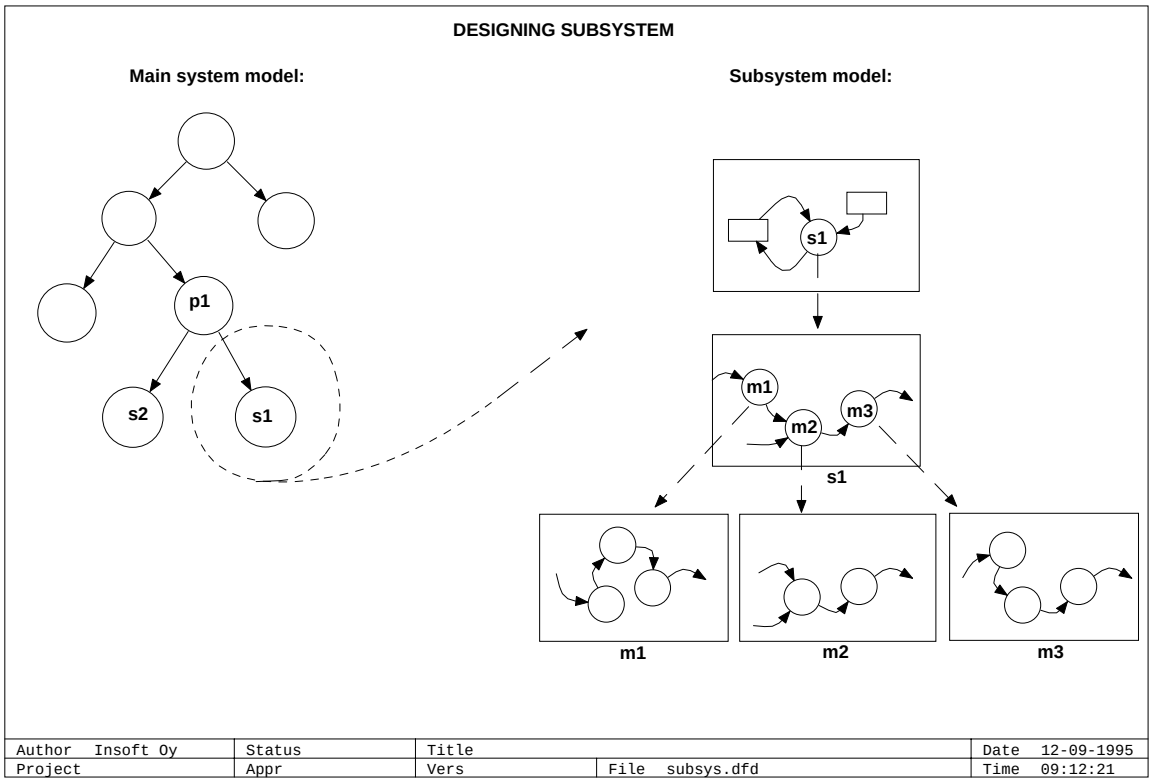

Figure 3.12 System and subsystem modeling.

Data bases can be arranged according to projects, designers, subsystems and reusable library objects. The protection of the model is realized in the diagram level and data dictionary protection is automatically consistent with the model protection.

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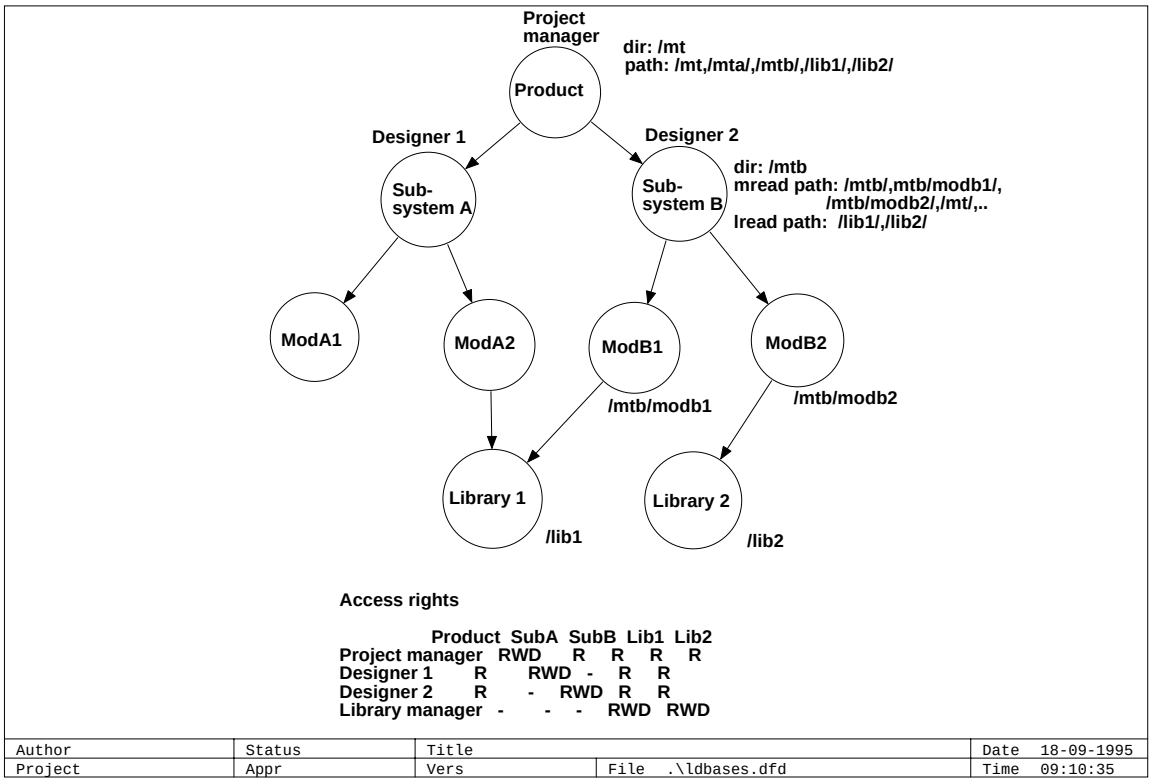

Figure 3.13 System and subsystem modeling.

3.4 State transition diagram

State transition diagram models the control part of the data flow diagram. State transition diagram consists of states and transitions. A state models externally observable behaviour of a data flow diagram. Transition models how state changes in state transition diagram. Control transformation presents the abstraction of the control in data flow diagrams. In SA/SD/RT method the control modeling is hierarchical and supports concurrent execution in different parts of the model.

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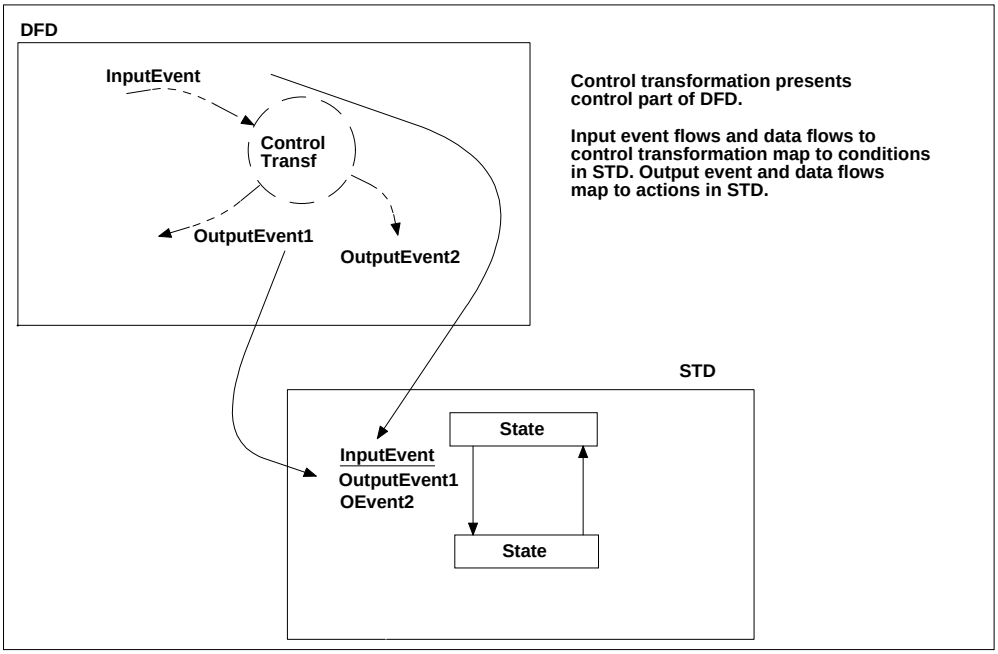

3.14 Control transformation integrates state transition diagrams and data flow diagrams.

3.4.1 State

A state models externally observable behaviour of a data flow diagram. States is normally named as "Doing Something". Start every word with a capital letter. A state may have several transitions in and out.

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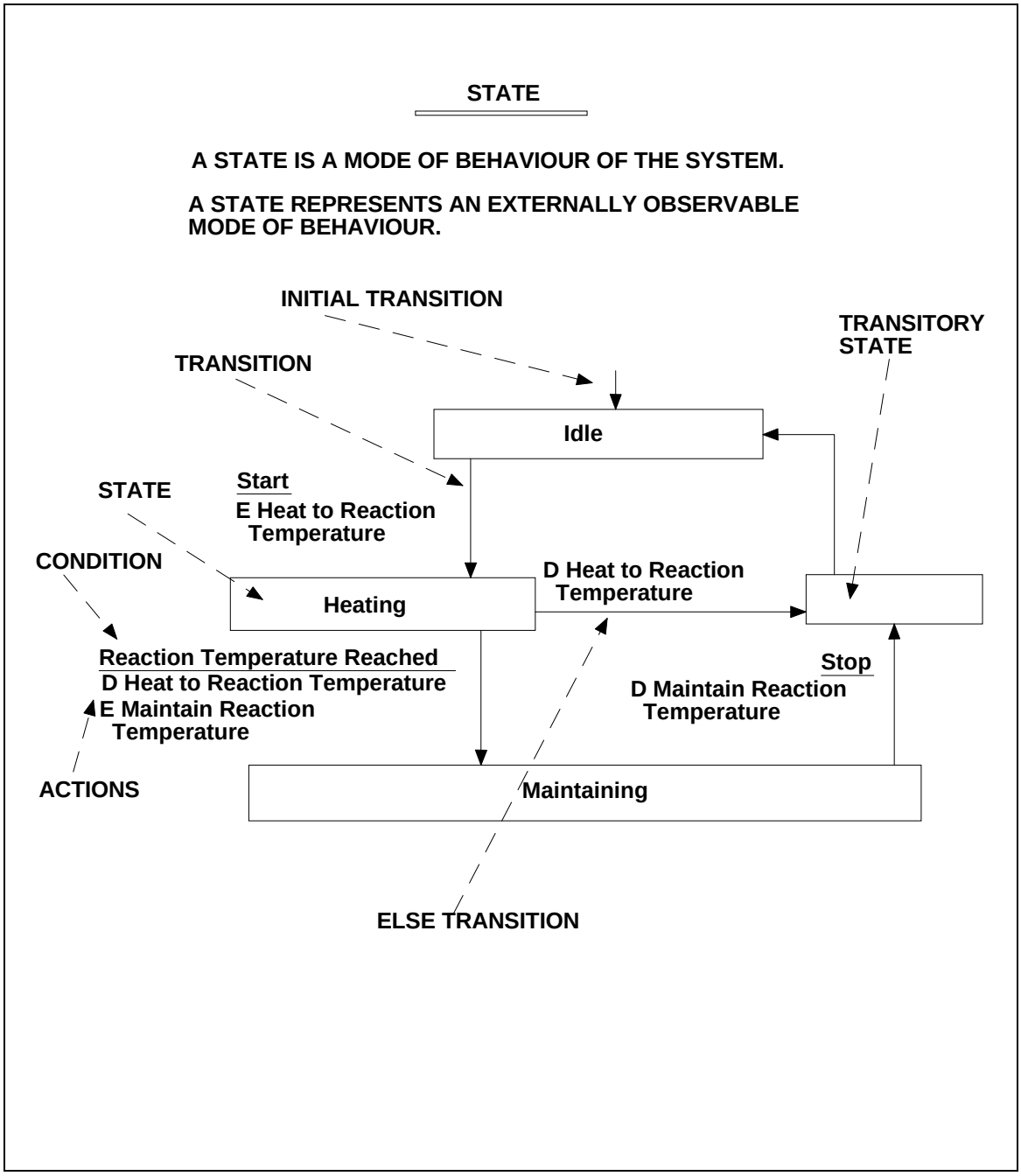

3.15 The modeling elements of the state transition diagram.

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3.4.2 Transition

Transition models changing of system state. A transitions happens if a certain condition is true. When a transition is made, the transition actions will be executed.

TRANSITIONS

TRANSITIONS REPRESENT THE MOVEMENT OF THE SYSTEM FROM ONE STATE TO ANOTHER

- **TRANSITIONS (LOGICALLY) TAKE NO TIME**
- **MULTIPLE TRANSITIONS TO/FROM A GIVEN STATE ARE PERMISSIBLE**
- **TRANSITIONS HAVE TWO PARTS: CONDITION AND ACTION**

CONDITIONS

TRANSITION CONDITIONS CAUSE THE SYSTEM TO MOVE FROM ONE STATE TO ANOTHER

CONDITIONS MAY INCLUDE:

- **EXTERNAL OR INTERNAL CONTROL SIGNALS**
- **ABSOLUTE OR RELATIVE DATA VALUES**
- **TIME SIGNALS**

ACTIONS

TRANSITION ACTIONS ARE CARRIED OUT BY THE SYSTEM AS IT MOVES FROM ONE STATE TO ANOTHER

ACTIONS MAY INCLUDE:

- **ISSUING CONTROL SIGNALS**
- **SETTING TIMERS**
- **ACTIVATING OR DEACTIVATING CONTINUOUS TRANSFORMATIONS**
- **TRIGGERING ONE SHOT TRANSFORMATIONS**

3.16 Transitions.

3.4.2.1 Condition

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A condition presents input data or event flows in the state transition diagram. A condition can have one part or it can be an expression of several parts.

```
Condition syntax:

condition       ::=  [operator] operand [{operator operand}]
operand         ::=  input_event_flow | local_variable | literal | constant
local_variable  ::=  string
literal         ::=  "string"
string          ::=  {character}
constant        ::=   integer | float
operator        ::=  [arithmetic_op | logical_op | relational_op]
arithmetic_op   ::= +                  *addition*
                      -                *subtraction*
                      *                *multiplication*
                      /                *division*
logical_op      ::=  AND               *logical and*
                     OR                *logical or*
                     NOT               *logical not*
relational_op   ::= <                  *less than*
                     >                 *greater than*
                    <=                 *less or equal than*
                    >=                 *greater or equal than*
                    ==                 *equal*
                    !=                 *not equal*
```

3.17 Condition syntax.

3.4.2.2 Action

One transition can have many actions. Actions are executed when a transition is made.

```
Action syntax:
action          ::=  [executive_ac | signalling_ac | assign_ac]
executive_ac    ::= Eheader data_transformation
 Eheader        ::= E(nable) | D(isable) | T(rigger) | Ac | De

signalling_ac   ::= Sheader output_flow
 Sheader        ::= R(aise) | L(ower) | S(ignal)

assign_ac       ::=  identifier = expression
 identifier     ::=  [output_flow | local_variable]
 expression     ::=  asgn_operand [operator asgn_operand]
 asgn_operand   ::=  [input_flow | local_variab | constant | literal]
 local_variab   ::=  string
 literal        ::=  "string"
 string         ::=  {character}

operator        ::=  [arithmeticop | logicalop]
 arithmeticop   ::=  [  +   |   -   |   *   |   /  ]
 logicalop      ::=  [ AND  |  OR  |  NOT ]
```

3.18 Action syntax.

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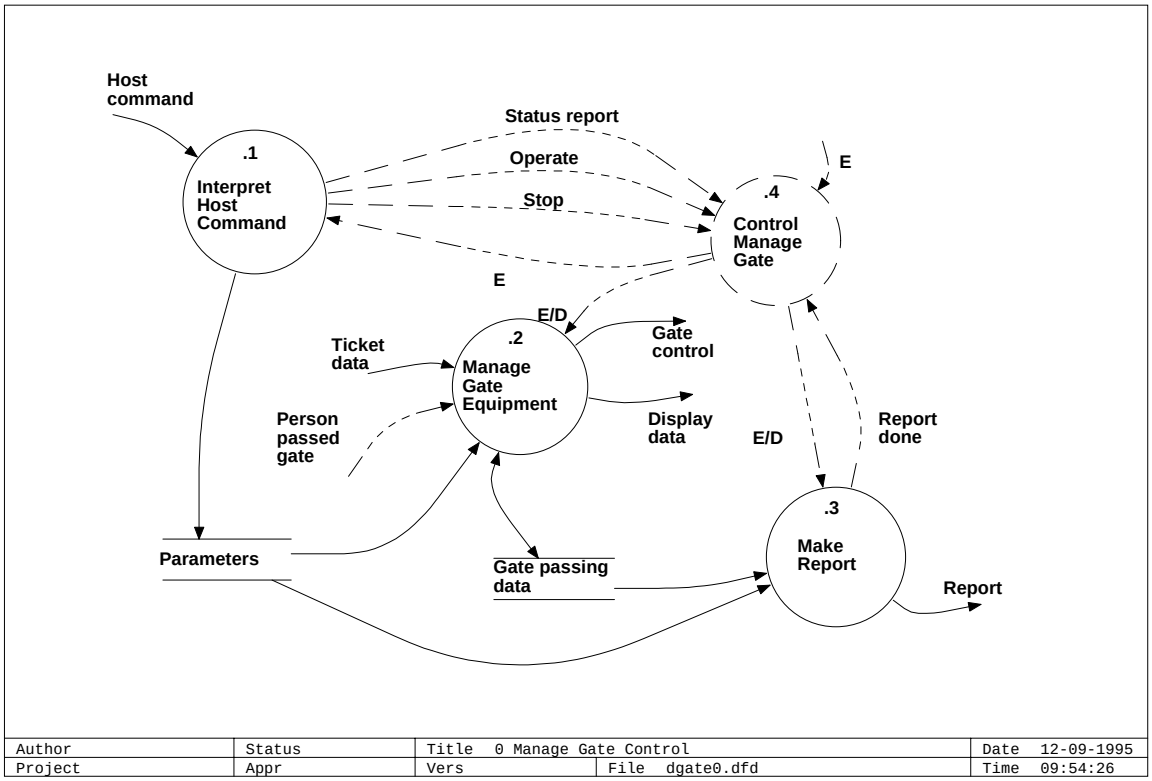
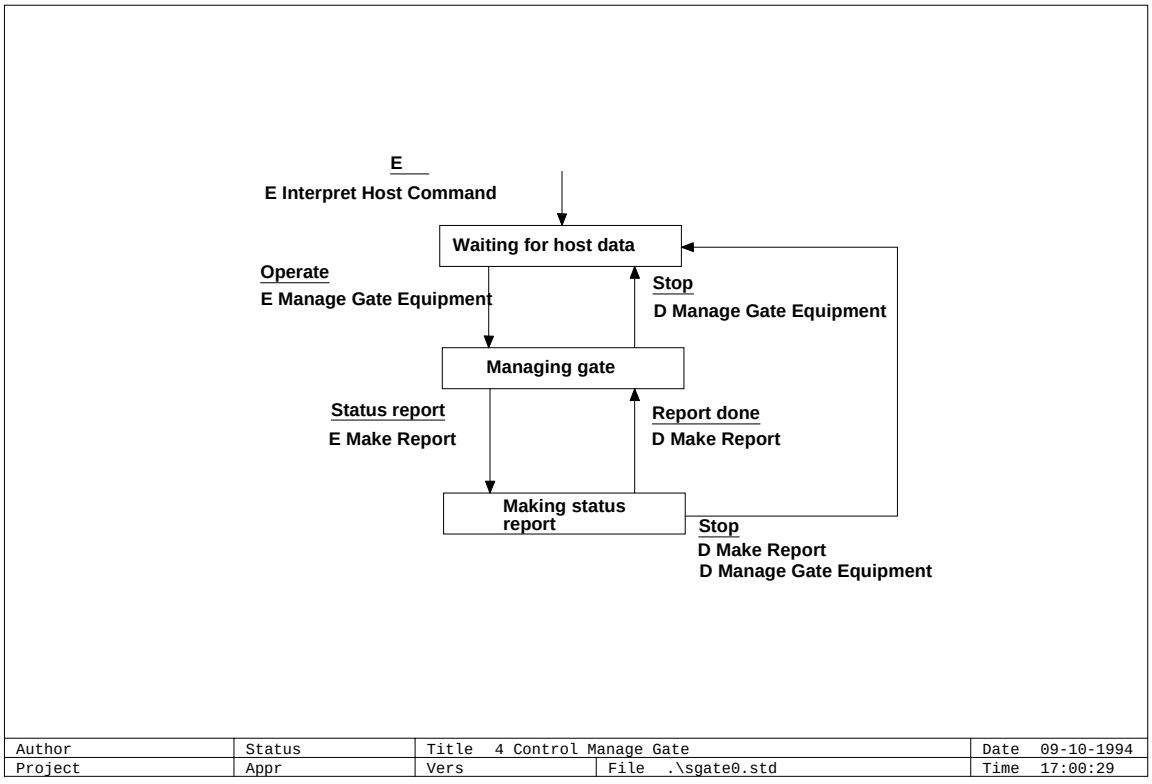
3.4.3 Example state transition diagrams



3.19 Adding control transformation.



3.20 Control Manage Gate state transition diagram.

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3.5 Data flow diagram with implicit control

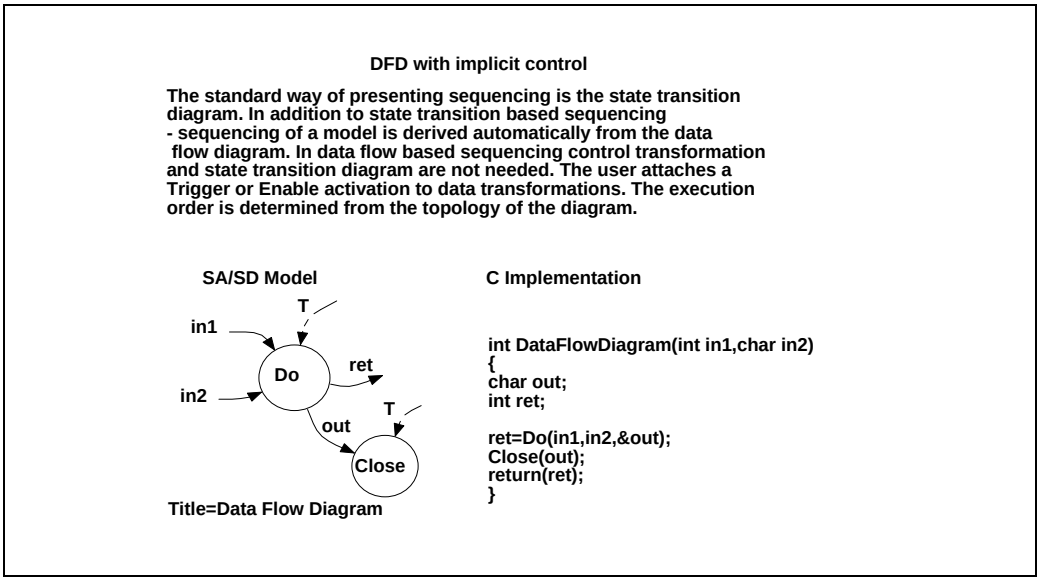
DFD with implicit control
The standard way of presenting sequencing is the state transition diagram. In addition to state transition based sequencing - sequencing of a model is derived automatically from the data flow diagram. In data flow based sequencing control transformation and state transition diagram are not needed. The user attaches a Trigger or Enable activation to data transformations. The execution order is determined from the topology of the diagram.
SA/SD Model
C Implementation
T
in1
Do
ret
in2
T
out
Close
Title=Data Flow Diagram
int DataFlowDiagram(int in1,char in2)
{
char out;
int ret;
ret=Do(in1,in2,&out);
Close(out);
return(ret);
}

Figure 3.21 DFD with implicit control.

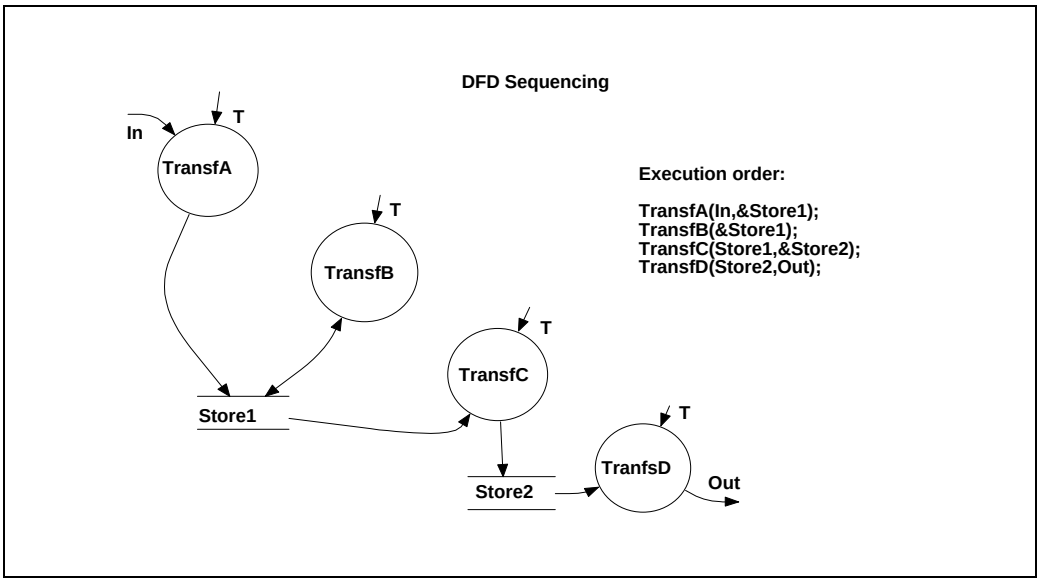

Figure 3.22 DFD sequencing.

3.6 Minispecification

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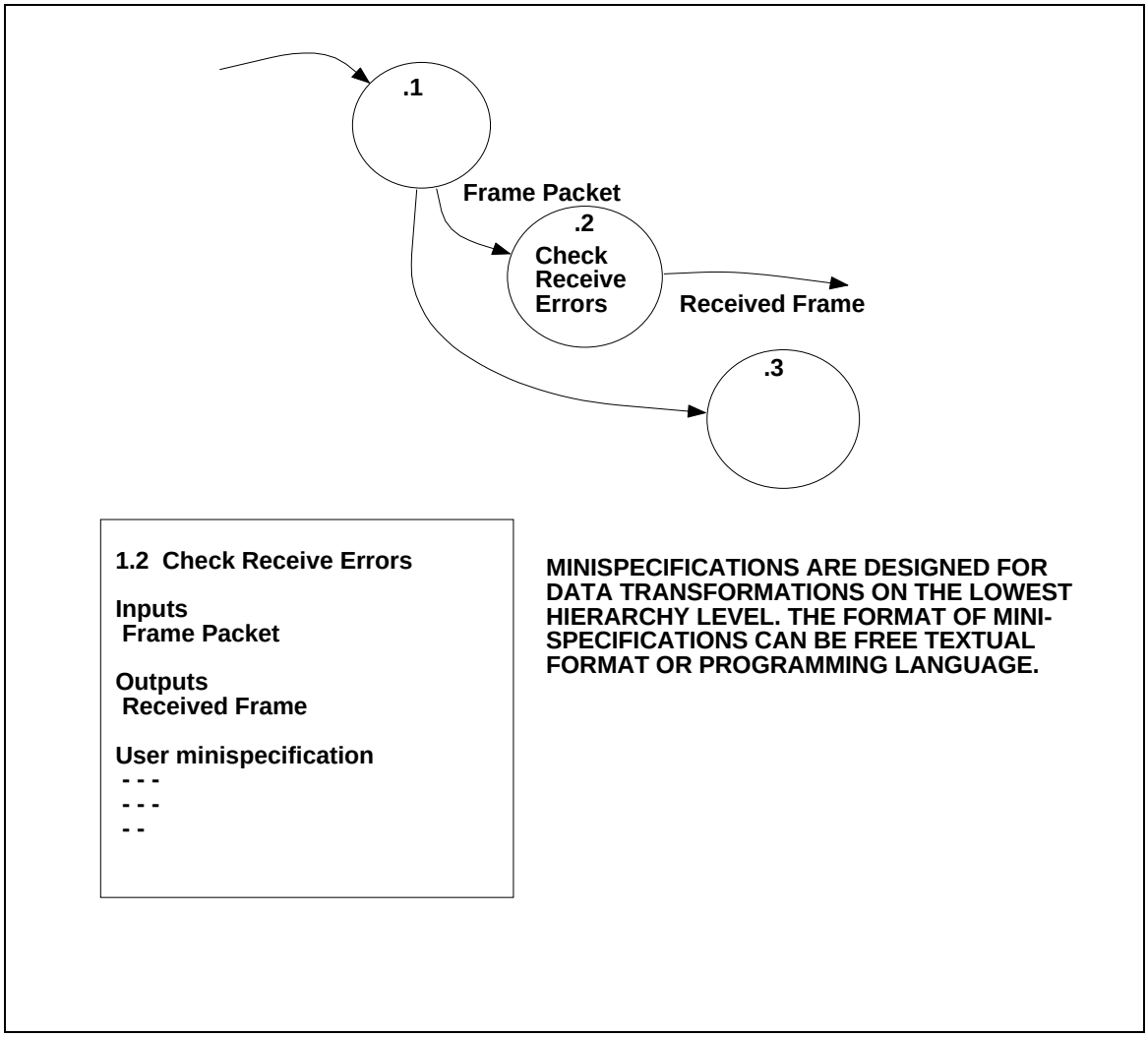

Figure 3.23 Minispecification.

(C) Copyright Insoft Oy

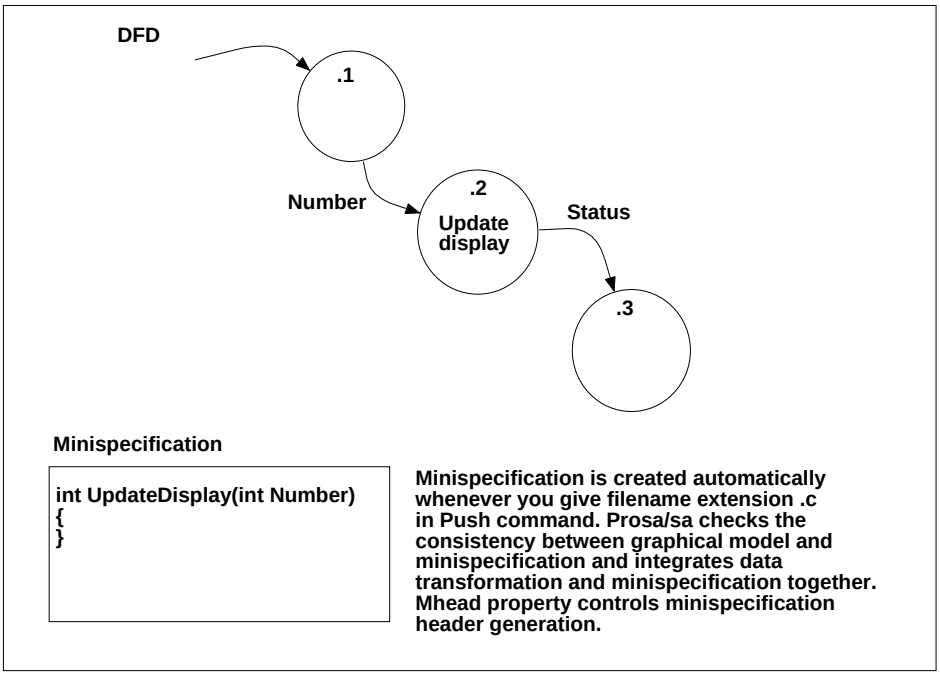
DFD
.1
Number
.2
Update display
Status
.3
Minispecification
int UpdateDisplay(int Number)
{
}
Minispecification is created automatically whenever you give filename extension .c in Push command. Prosa/sa checks the consistency between graphical model and minispecification and integrates data transformation and minispecification together. Mhead property controls minispecification header generation.

Figure 3.24 Minispecification in C syntax.

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3.7 Data Dictionary

Data flows, event flows, data stores and buffers appearing in data flow diagrams can be further defined in the Data Dictionary. By using Data Dictionary you can effectively package information in your models. Always when a new modeling element is taken into SA/SD model, the element name will be put into the Data Dictionary.

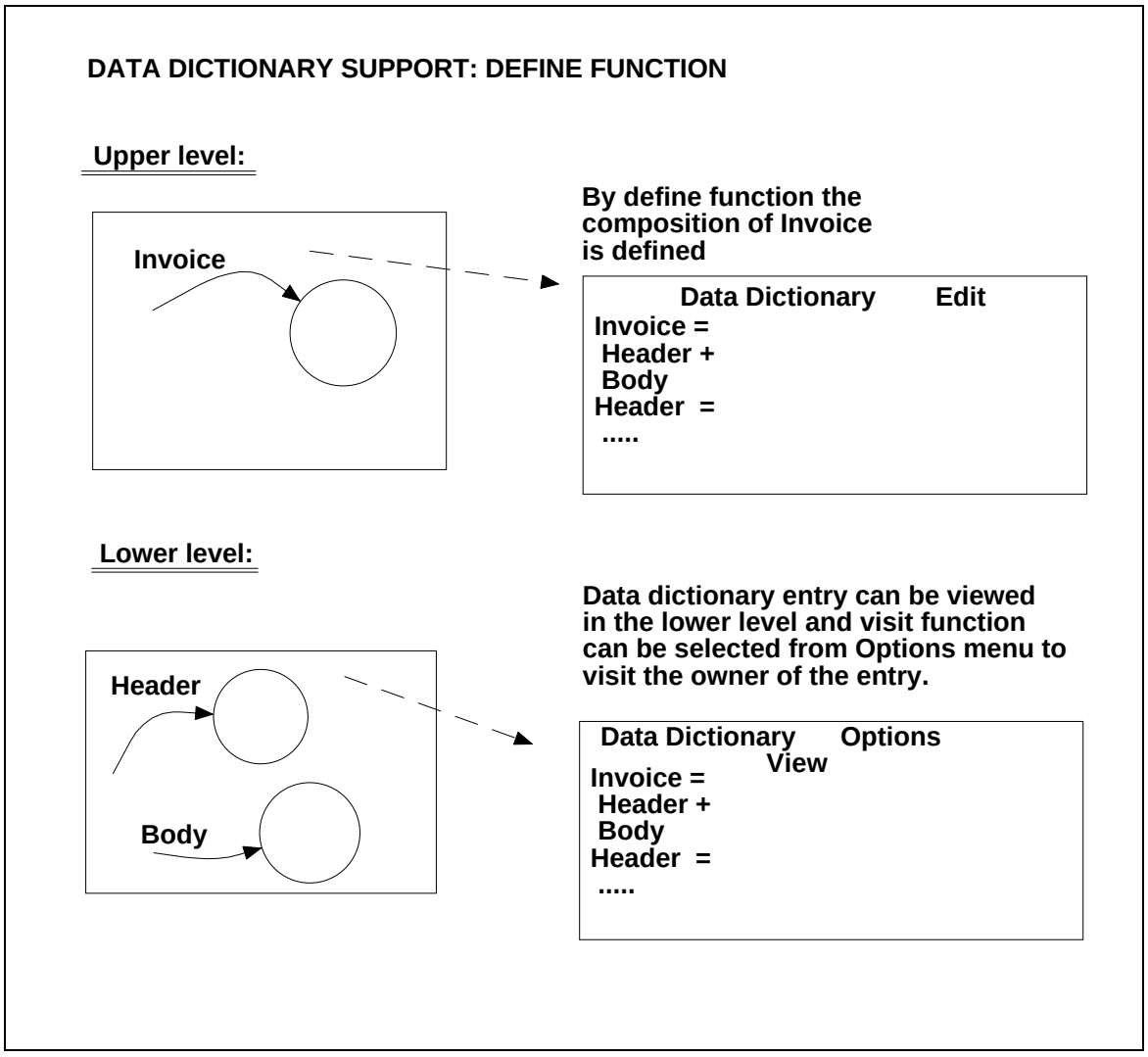

Figure 3.25 Defining information in Data Dictionary.

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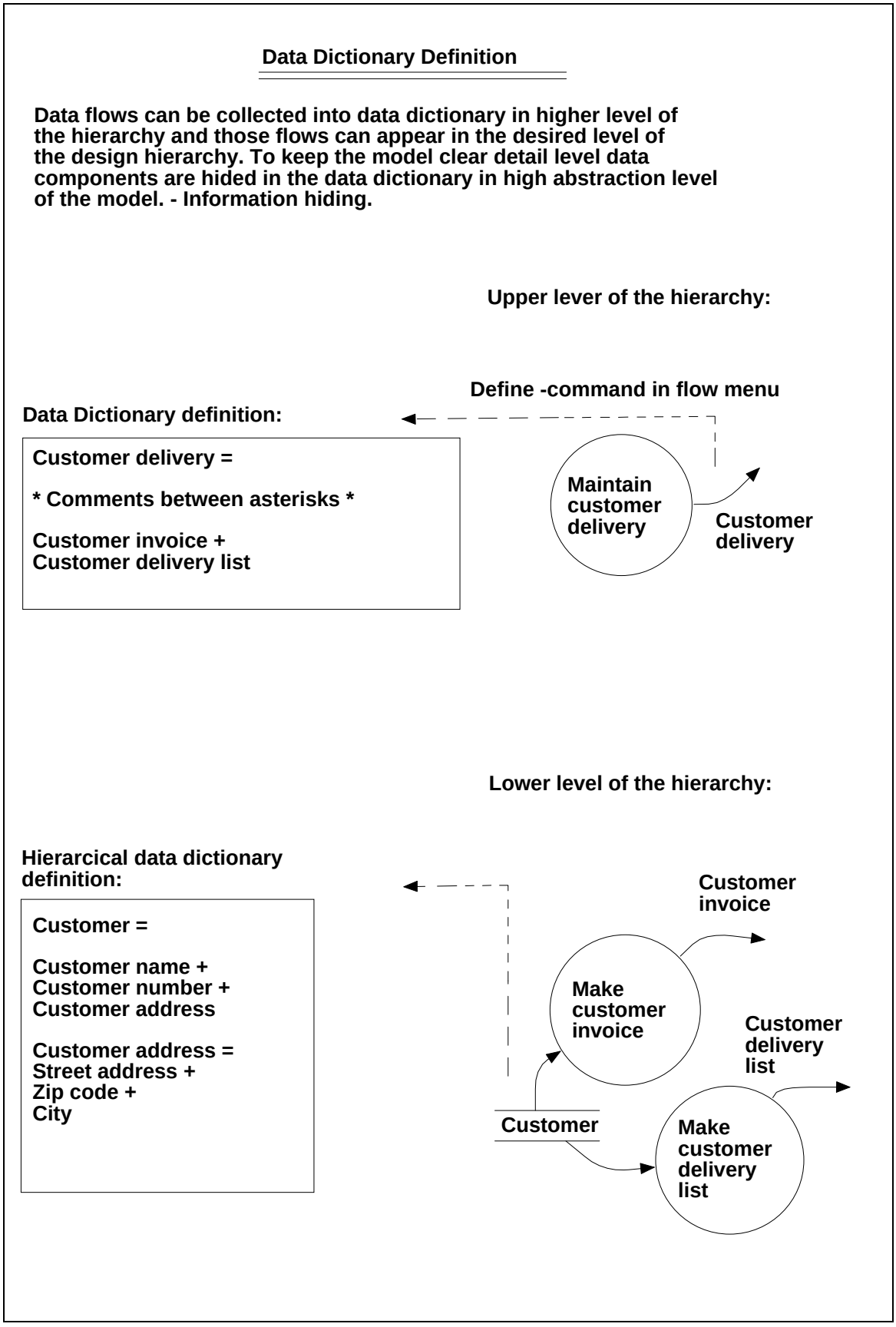
Data Dictionary Definition
Data flows can be collected into data dictionary in higher level of the hierarchy and those flows can appear in the desired level of the design hierarchy. To keep the model clear detail level data components are hided in the data dictionary in high abstraction level of the model. - Information hiding.
Upper lever of the hierarchy:
Define -command in flow menu
Data Dictionary definition:
Customer delivery =
* Comments between asterisks *
Customer invoice +
Customer delivery list
Maintain customer delivery
Customer delivery
Lower level of the hierarchy:
Hierarcical data dictionary definition:
Customer =
Customer name +
Customer number +
Customer address
Customer address =
Street address +
Zip code +
City
Customer invoice
Make customer invoice
Customer delivery list
Customer
Make customer delivery list

Figure 3.26 Hierarchical Data Dictionary definition.

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```
DataEntity =
[comment]
[aliasname]
component [{operator component}]
[{component =
component [{operator component}] } ]
DataEntity      ::=  flow | store | entity
flow            ::=  string
store           ::=  string
entity          ::=  string
component       ::=  string [typespecifier | aliasname | comment] | comptype
operator        ::=   [ and | or ]
and             ::=  +
or              ::=   |
aliasname       ::=  cmtstart  a=component  cmtstop
typespecifier   ::=  cmtstart [string]  t=comptype [string] cmtstop
comptype        ::=  string |                  * Variable type *
                      string* |                * Pointer type  *
                      (string [{string}])      * Type with specifiers *
comment         ::= cmtstart  string  cmtstop
cmtstart        ::= *                          * a space, tabulator  or newline character  must precede  *
cmtstop         ::= *                          * a space or tabulator  character must precede *
string          ::= {character}
```

Figure 3.27 Data Dictionary syntax.

```
Example data dictionary definition:

Customer =
* Customer data store definition  *
CompanyName +
Address

Address=
StreetAddress+
ZipCode+
City
```

Figure 3.28 Data Dictionary definition example.

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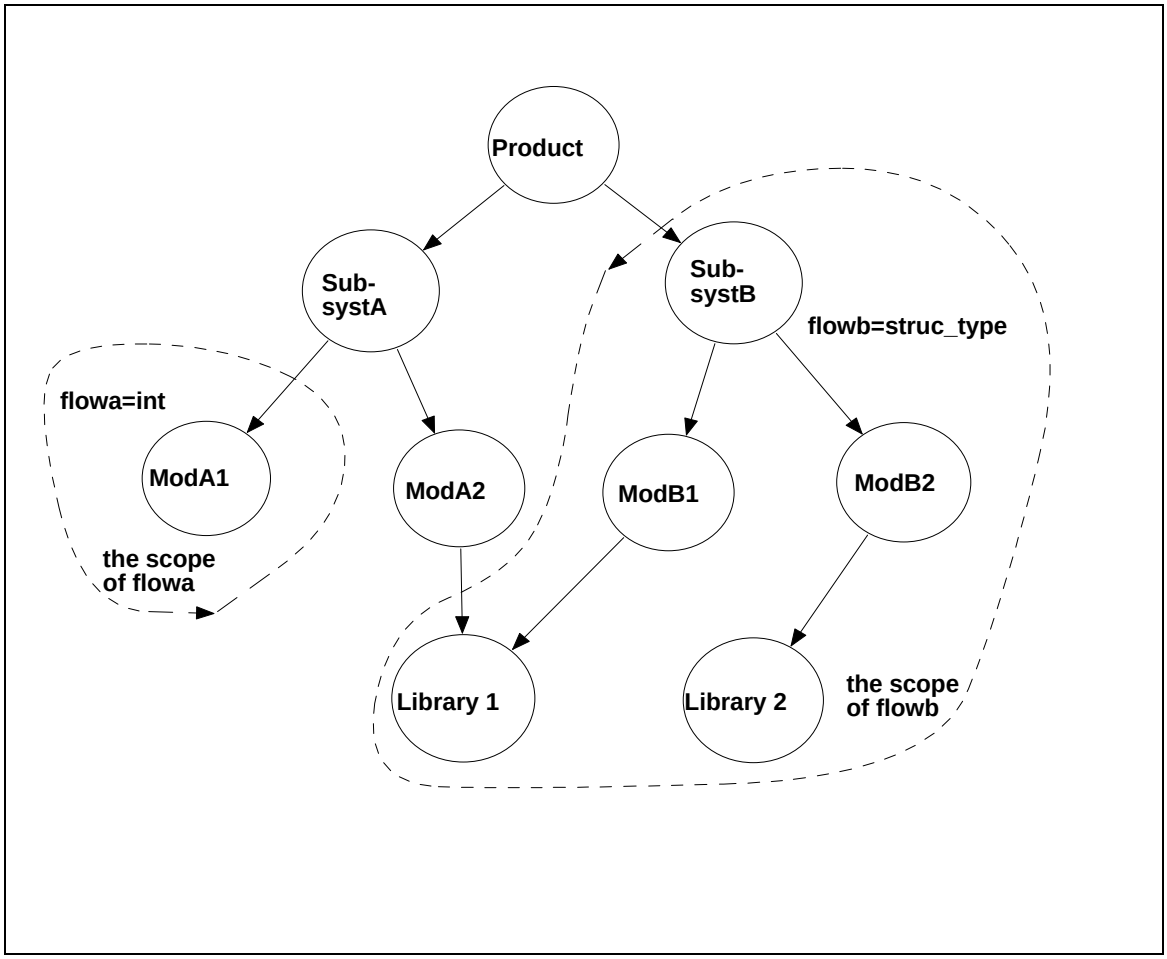

Figure 3.29 Scopes of Data Dictionary definition.

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4 INFORMATION MODEL

4.1 Description of the information model

Information model defines the data of the application. Information model or data model is presented with entity relationship diagrams. In entity relationship diagramming Chen's and Bachman's notations are supported. In information models the application data entities and their relationships are modelled. Information models and behavioural models integrate with each others - data which is defined in information model is created and maintained in behavioural models. Although information models are commonly understood to be a part of information systems analysis and design, they can be used in all kinds of applications.

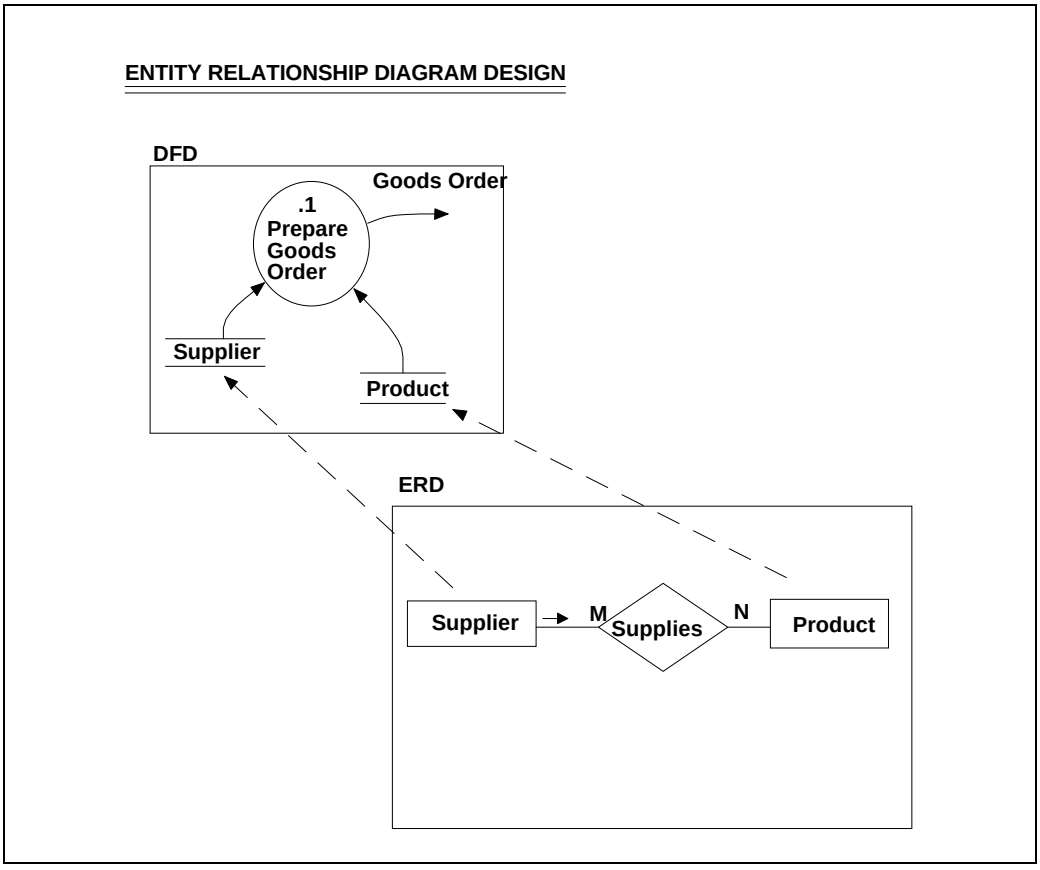

Figure 4.1 Using information modeling.

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4.1.1 Entity

The entities of the entity relationship diagram model information concepts of the application. Entities may have one or several instances in the data flow diagrams as data stores, data buffers or data flows. The characteristics of each entity can be defined in the data dictionary similarly as data flows and data stores.

4.1.2 Relationship

Relationships are used to model the connections between entities of the application. Relationships have an important role when implementing information models in relational data base management system.

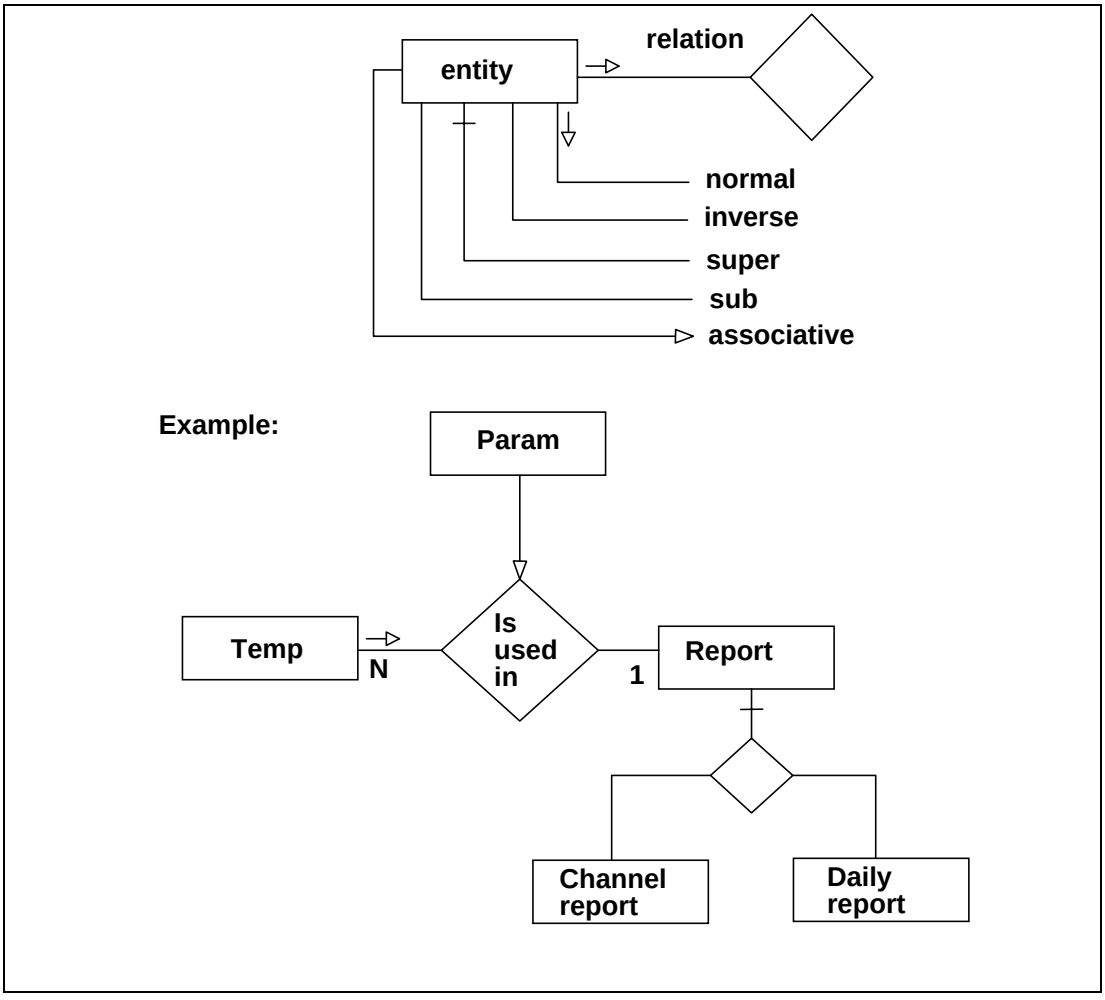

Figure 4.2 Chen's ER diagram.

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4.2 Integration of ERD's and DFD's

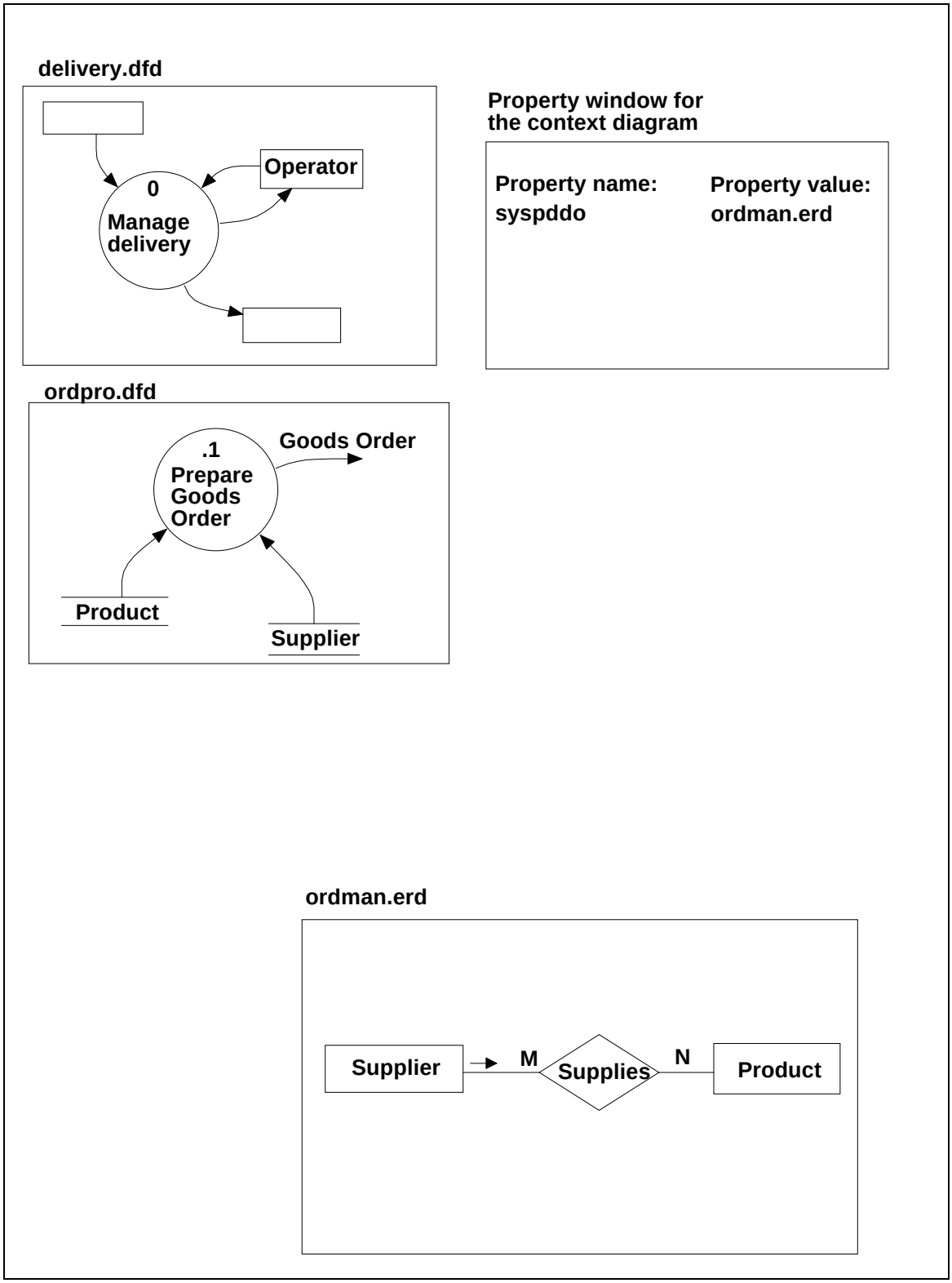

Figure 4.3 Integration of information and behavioural models.

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4.3 Example information model

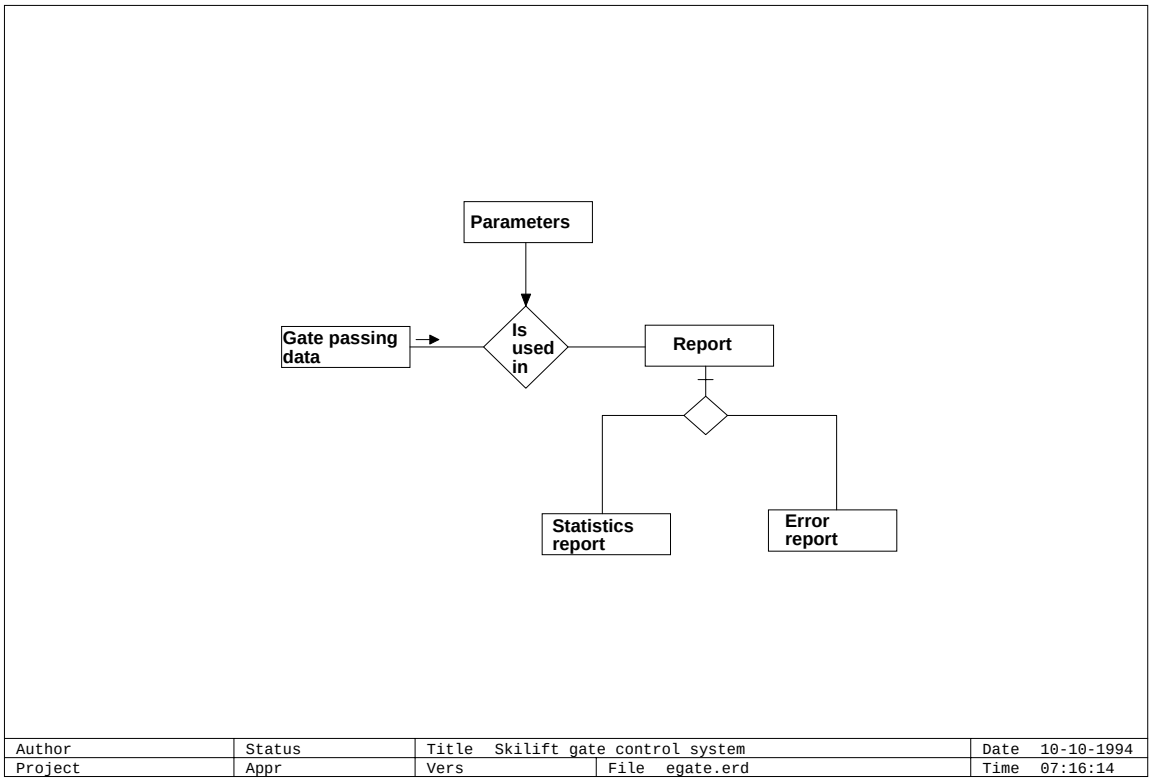

Figure 4.4 Skilift gate control system information model.

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5. NAMING INSTRUCTIONS

5.1 Model and model file naming

Use descriptive model names. In hierarchical behavioural model the child model automatically inherits the name of its parent. Name model files so that the context diagram filename describes the project name. The event list has the same filename as context diagram except the extension is **.elt.** Append 0 to the end of context diagram file name to create the 0-level data flow diagram file name e.g. dremix0.dfd. Name all other model files according to function that it performs. Figure 5.1 presents file name extensions and prefix characters for different model types.

Context diagram	**d**appnam.**dfd**	* derived from application name
Event list	**d**appnam.**elt**	* derived from application name
0-level dfd	**d**appnam0.**dfd**	*
0-level std	**s**appnam0.**std**	*
Other dfd's	**d**dgrnam.**dfd**	* derived from diagram name
Other std's	**s**dgrnam.**std**	*
Minispecifications	**c**msnam.**mst**	* derived from transform. name
ER-diagrams	**e**dgrnam.**erd**	* derived from application name

Figure 5.1 Model file name usage.

5.2 Naming of SA/SD/RT modeling elements

The naming instructions have been presented in corresponding sections of Environment model, Behavioural model and Information model.

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6. PROSA/OM/SA CASE ENVIRONMENT

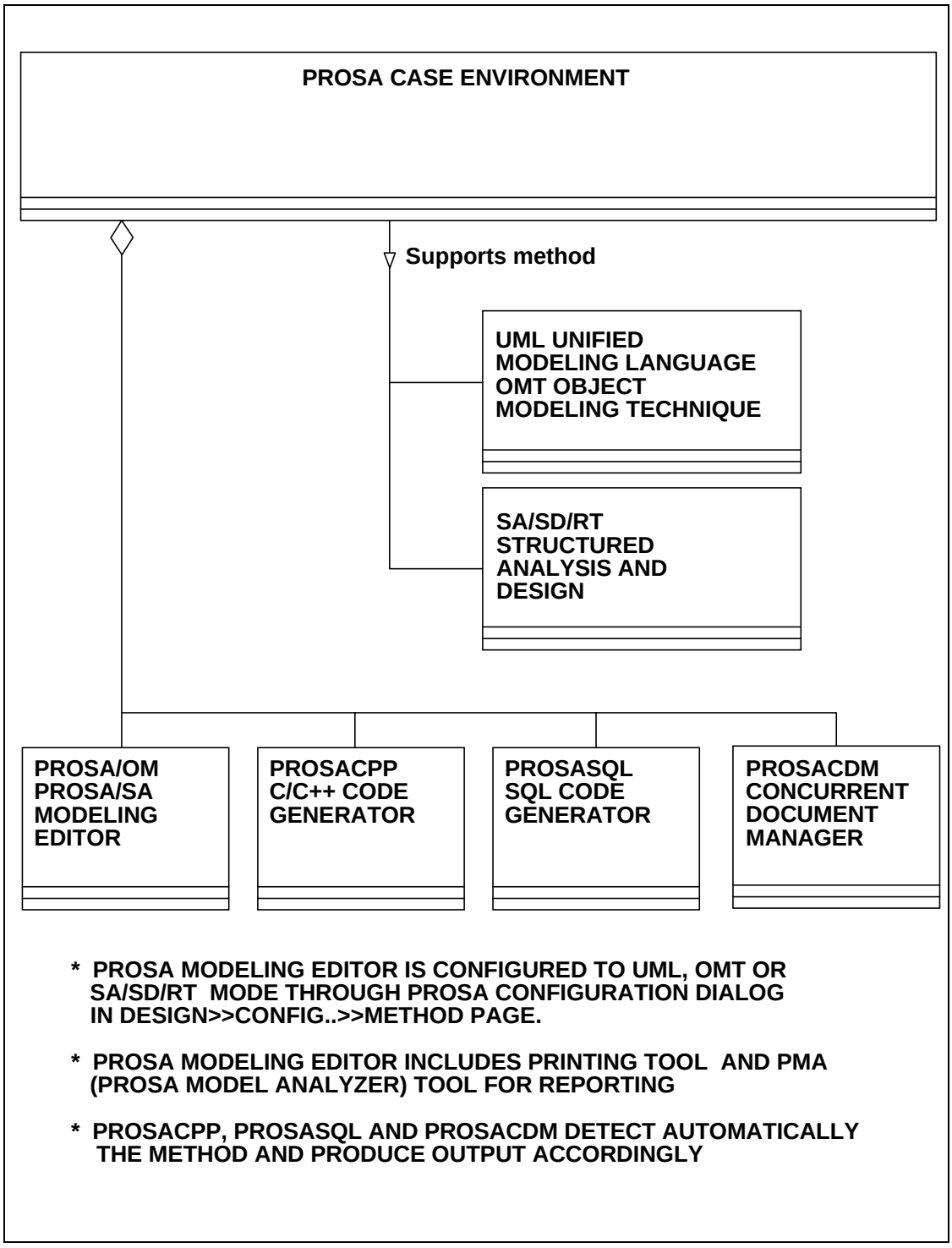
PROSA CASE ENVIRONMENT
Supports method
UML UNIFIED MODELING LANGUAGE OMT OBJECT MODELING TECHNIQUE
SA/SD/RT STRUCTURED ANALYSIS AND DESIGN
PROSA/OM PROSA/SA MODELING EDITOR
PROSACPP C/C++ CODE GENERATOR
PROSASQL SQL CODE GENERATOR
PROSACDM CONCURRENT DOCUMENT MANAGER
* PROSA MODELING EDITOR IS CONFIGURED TO UML, OMT OR SA/SD/RT MODE THROUGH PROSA CONFIGURATION DIALOG IN DESIGN>>CONFIG..>>METHOD PAGE.
* PROSA MODELING EDITOR INCLUDES PRINTING TOOL AND PMA (PROSA MODEL ANALYZER) TOOL FOR REPORTING
* PROSACPP, PROSASQL AND PROSACDM DETECT AUTOMATICALLY THE METHOD AND PRODUCE OUTPUT ACCORDINGLY

Figure 6.1 Prosa Case Environment.

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7. SETTING UP PROJECT, CONFIGURING PROSA

7.1 Setting up a project

Prosa/sa model consists of a set of diagrams. Prosa/sa links the diagrams together to form an integrated model. Each diagram is a separate document or file in project folder(s). The following presents the steps of setting up a project:

1. Create project folder.
2. Start **Prosa/sa**.
3. Add the name of the project folder to Model Read Paths of Prosa/sa through Path page of the Prosa/sa Configuration dialog. Configuration dialog opens by selecting **Config…** item from the **Design** menu.
4. If you intend to reuse existing model libraries, add the location of your libraries to Library Read Paths in the same dialog.

At the beginning of each modeling session, you must change the working directory to your project folder through **Chdir** item in the **Utilities** menu.

In Windows environment you can change the working directory of Prosa permanently. Click on Prosa icon, press the right mouse button and select Properties/Shortcut page.

Figures7.1-4 present an example of creating project folder, adding the folder to Prosa Model Read Paths and changing Prosa working directory.

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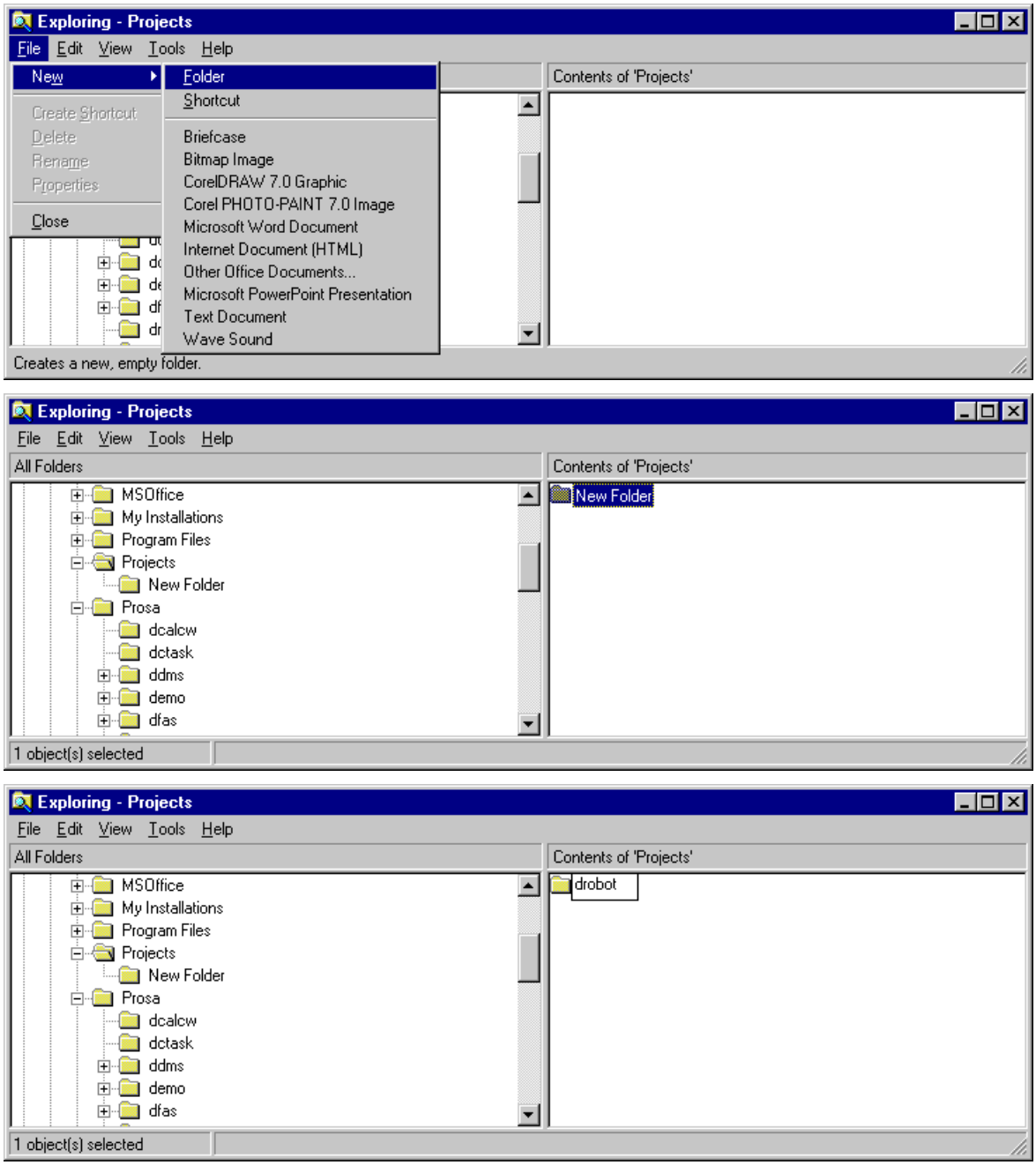

Figure7.1 Creating project folder.

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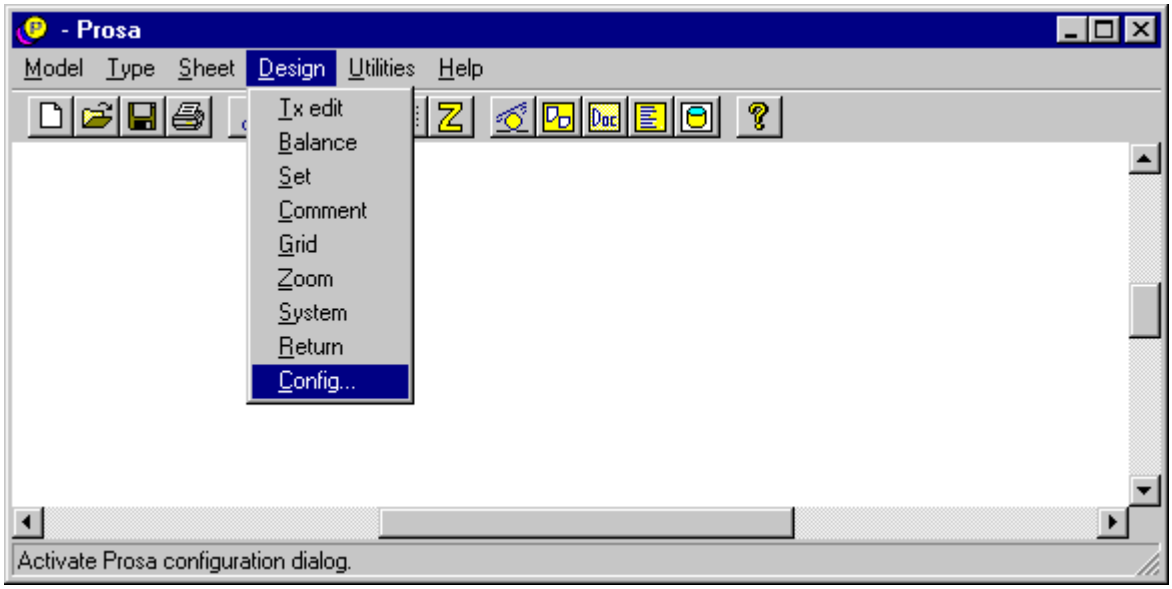
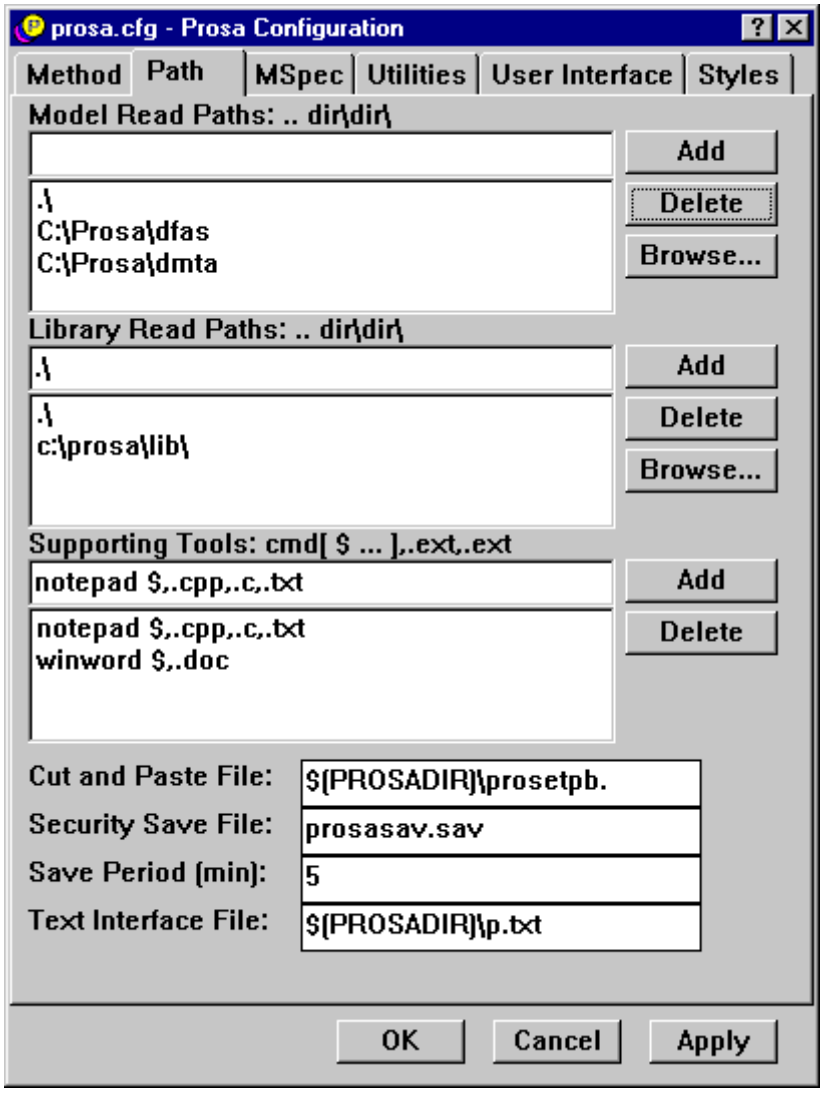


Figure7.2 Opening Prosa Configuration Dialog.



(C) Copyright Insoft Oy

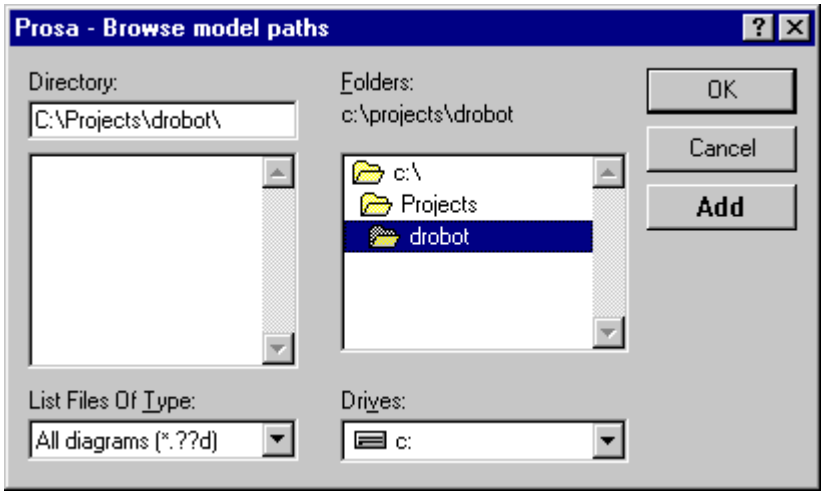


Figure7.3 Adding a project folder to Model Read Paths.

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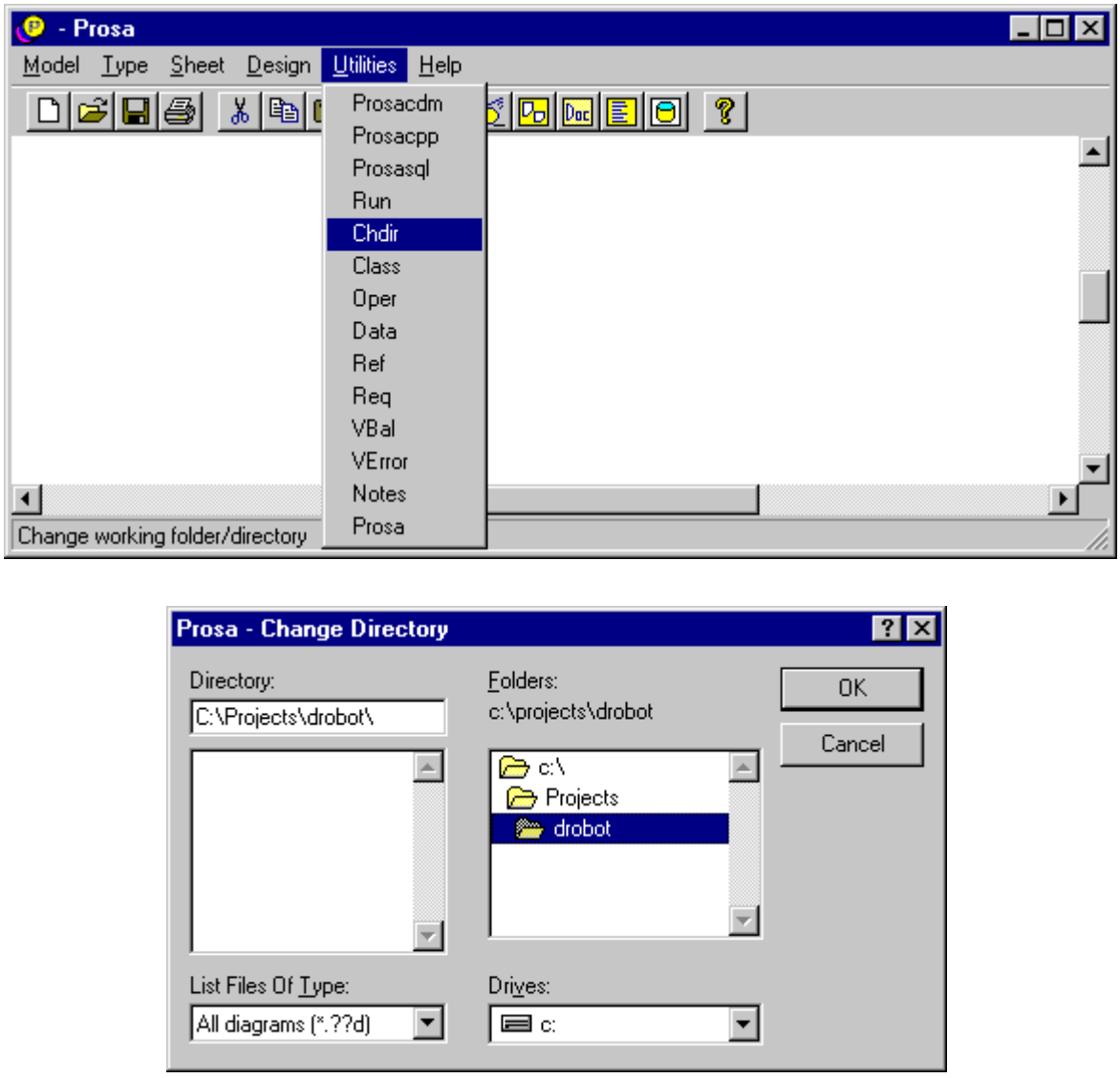

Figure7.4 Changing working directory.

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7.2 Setting up a multi-designer project

Prosa/sa supports project teams. **Prosa/sa** supports both centralised and distributed model database architectures in multi-designer projects.

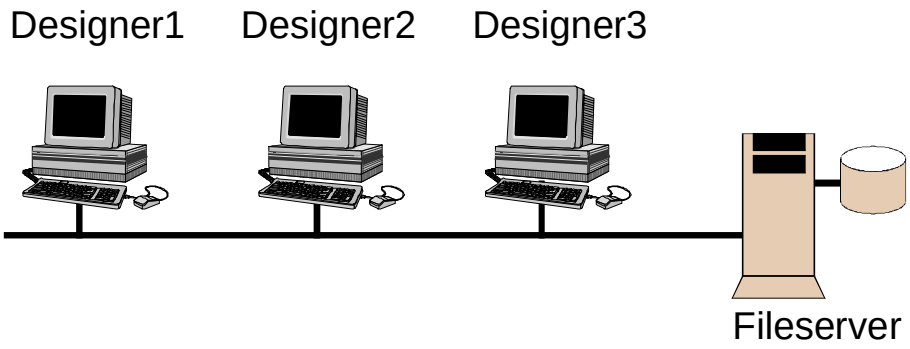

Figure7.5 Centralised multi-designer model database.

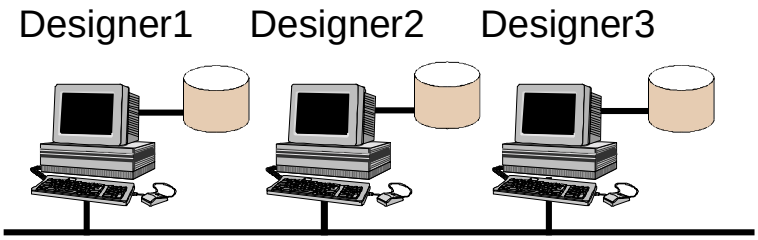

Figure7.6 Distributed multi-designer model database.

Setting up a multi-designer project occurs in the same way as presented in Chapter 7.1, except that all folders belonging to the project must be listed in the Prosa Model Read Paths of every designer. Project members can use common Prosa configuration settings by defining environment variable **PROSACFG** to point to the same configuration file on the operating system level.

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7.3 Personal and global Prosa configurations

Prosa/sa stores and maintains all such information that is entered through Prosa Configuration Dialog Design>>Config… in Prosa configuration file. The active configuration is told to Prosa/sa through environment variable PROSACFG. Figure 7.7 presents the default setting of Prosa environment variables. PROSADIR environment variable points to folder which contains Prosa executable files, PROSAAUTH environment variable points to folder which contains Prosa authorization files.

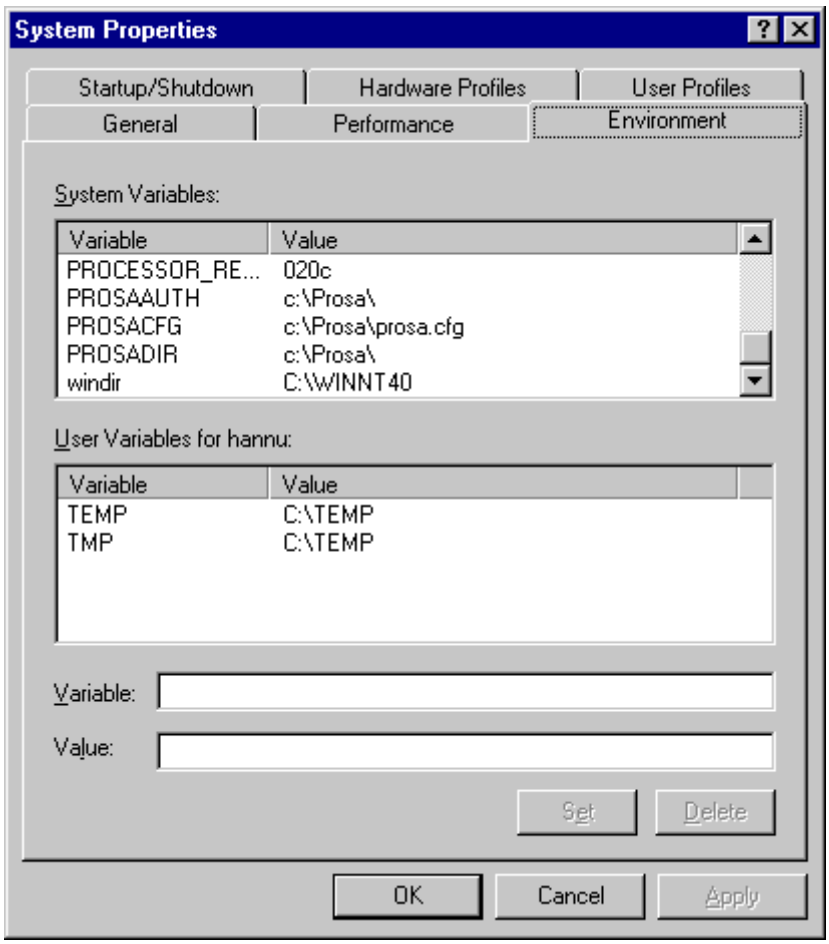

Figure7.7 Distributed multi-designer model database.

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7.4 Making a personal Prosa configuration

The following steps show how you create a personal configuration in Unix environments. In Windows NT you use System item in the Control panel for the same purpose.

1. *Make personal configuration file and change PROSACFG environment variable.*
   # cp /usr/prosa/prosa.cfg <usr login dir>
   # PROSACFG=<usr login dir>prosa.cfg
   # export PROSACFG

After starting Prosa, the functionality and working ergonomics of Prosa/sa can be configured through **Config…** item in **Design** menu. Prosa/sa configuration information is stored in Prosa configuration file. Prosa/sa searches the configuration file name from PROSACFG environment variable, which by default after installation points to the file prosa.cfg in Prosa/sa home directory. According to your needs, it is thus possible to have global, project specific or personal Prosa/sa configurations.

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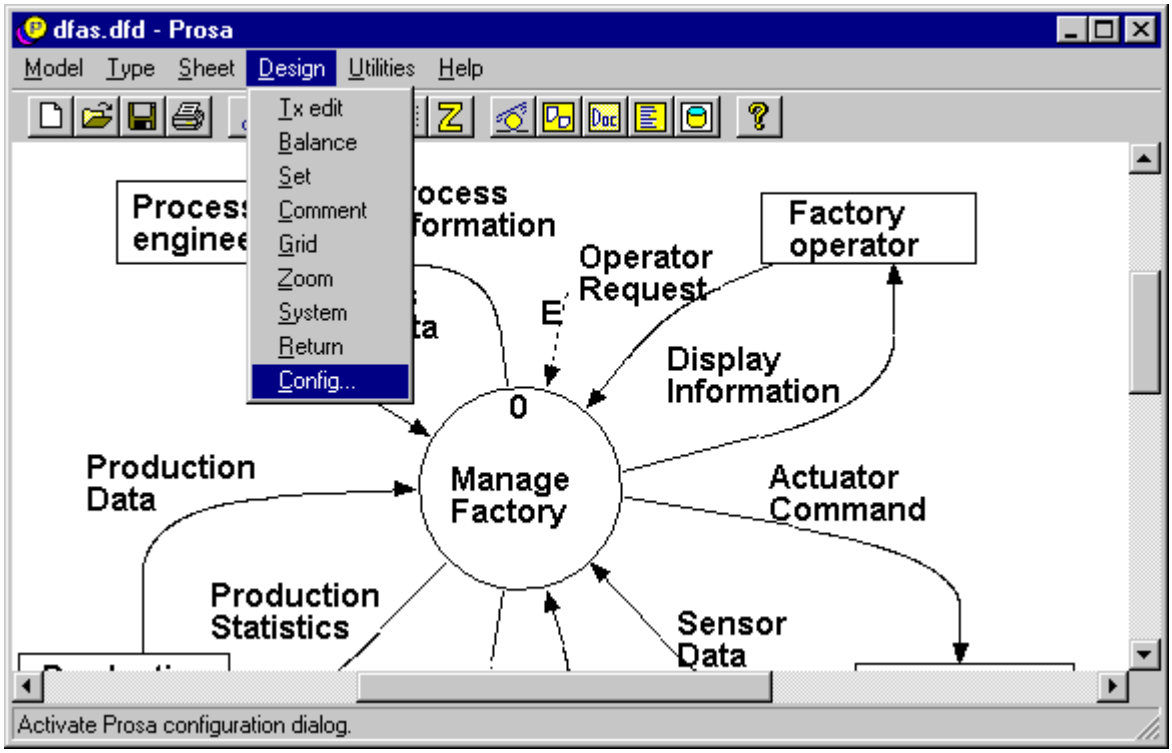

Figure 7.8 Opening Prosa/sa configuration dialog.

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7.4.1 Method page of Prosa Configuration

Figure 7.9 Method page.

7.4.1.1 Modeling Method

SA/SD/RT selects Structured Analysis and Design for Real-Time systems-method. UML selects Unified Modeling Language method. OMT selects Use Case/OMT, Object Modeling Technique -method.

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7.4.1.2 Name Prefixes

Defines default prefixes for class and instance names in OMT mode. Prefixes are applied when Prosa automatically maps between object and class names in Pick -operation between UCD-OMD or OID-OMD or DFD-OMD.

7.4.1.3 ERD Notation

In SA/SD/RT modeling mode either Bachman's or Chen's ERD notation can be selected.

7.4.1.4 Date Format

Defines format for automatically maintained date stamp in the title block of a diagram.

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7.4.2 Path page of Prosa Configuration

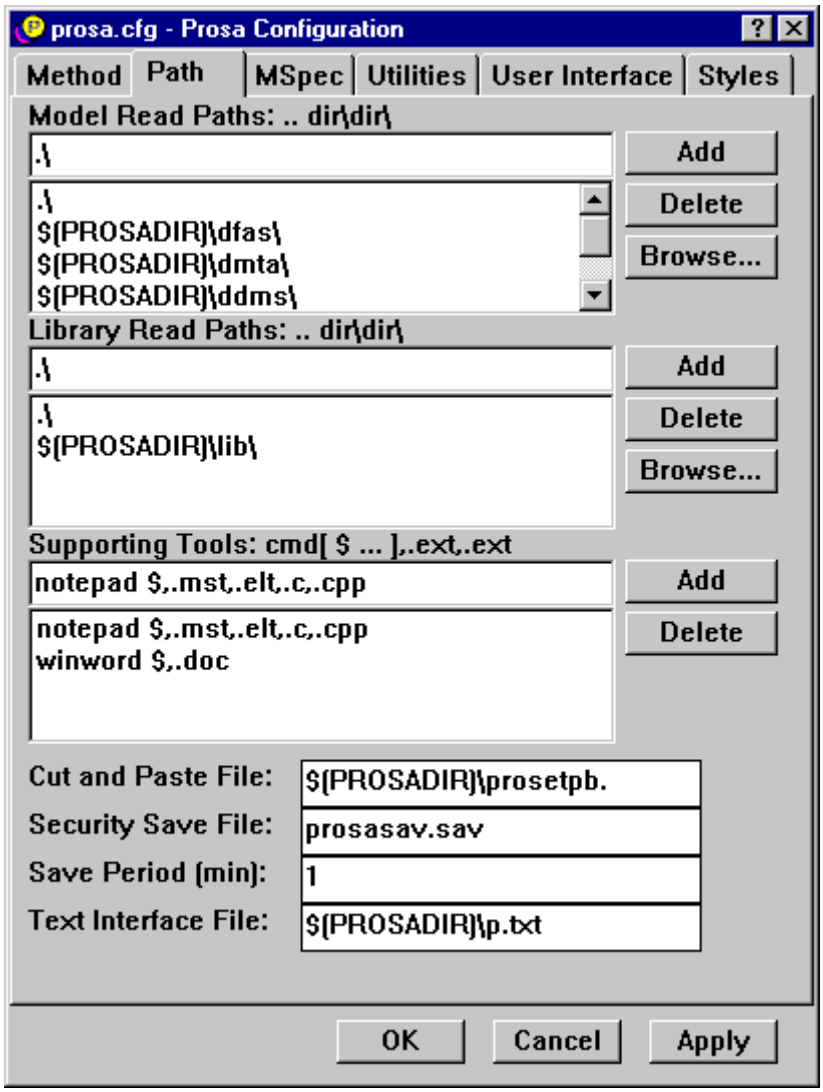

Figure7.10 Path page.

$(PROSADIR) is a placeholder for the value of PROSADIR environment variable.

7.4.2.1 Model Read Paths

The path list defines all directories which are searched when Prosa opens or saves a diagram. With model read path you can set up your project environment and allocate effectively your project between subsystems and/or designers in team environment.

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7.4.2.2 Library Read Paths

The path list defines all directories which are searched when you open a library component through **OpenL...** selection of the **Model** -menu.

7.4.2.3 Supporting Tools

The list defines tool and filename extension bindings. Prosa uses this list to activate the programmed tool for a particular modeling document. Define complete command line first with any command line switches. Use '$' character for the placeholder of the modeling document name. After the command line, use comma as a separator and list all filename extensions, which should result in activating the command defined. E.g.: notepad $,.mst,.elt,.c,.cpp

7.4.2.4 Cut and Paste File

Defines the buffer file for graphic cut and paste (set) operations between Prosa windows. During cut and paste, Prosa transfers also all the intelligence of the model portion, like rubberbanding connections of the symbols, properties, attributes, operations and data dictionary definitions.

7.4.2.5 Security Save File and Save Period

Prosa performs periodically the security save of the model currently being edited in Prosa window.

7.4.2.6 Text Interface File

The file is used as an interface between graphic and textual modeling documents. When you enter a textual model through Prosa graphic model, Prosa interactively checks the two models and writes the result in the text interface file. Normally the Utilities menu command "VError" has been programmed to show this file in the text editor.

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7.4.3 MSpec page of Prosa Configuration

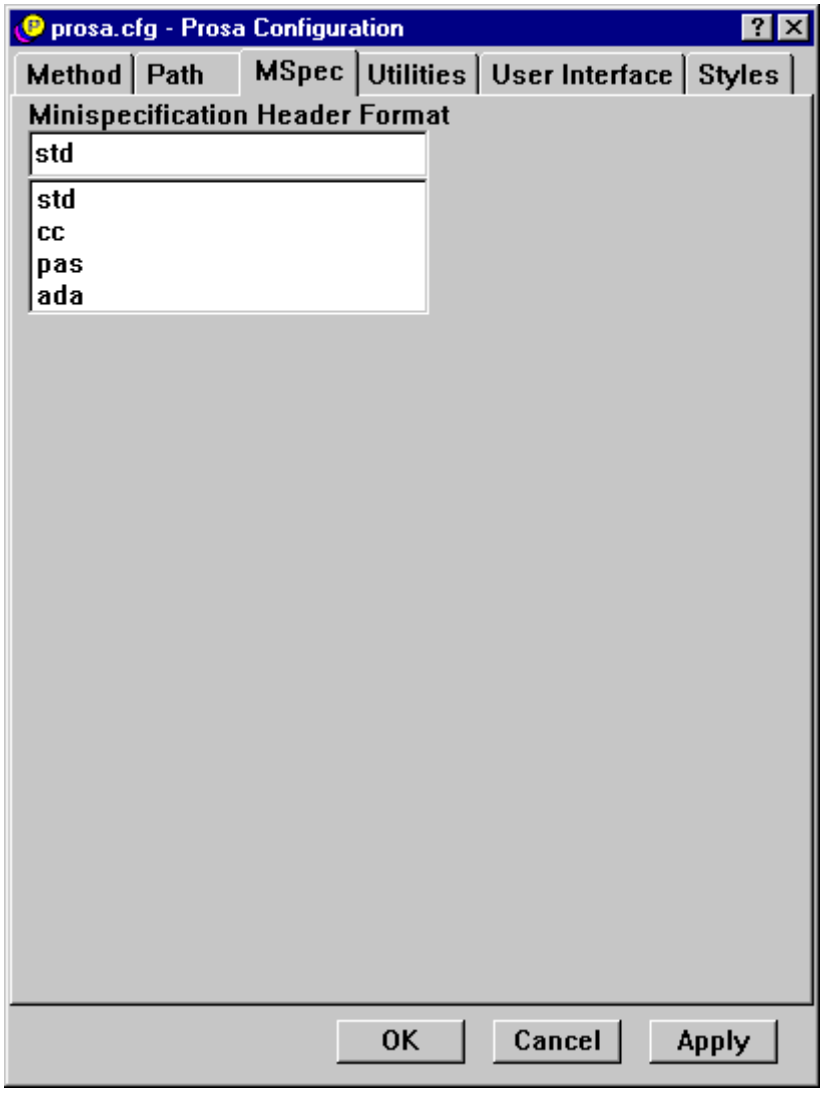

Figure 7.11 MSpec page.

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7.4.3.1 Minispecification header format (SA/SD/RT)

When you select a Push function from a data transformation menu, Prosa lets you to define a graphic (no filename extension or .dfd) or textual (.mst or .c extension, among others) model for that transformation. In case of textual model, the selected minispecification header format is used to automatically create the header or skeleton for that transformation. The same is used in checking interactively the consistency between data flow diagrams and minispecifications.

7.4.3.2 Operation specification header format (UML, OMT)

When you click on operation name of a certain class, Prosa lets you to define a graphic (no filename extension or .dfd) or textual (.cpp extension) model for that operation. In case of textual model, the selected operation specification header format is used to automatically create the header or skeleton for that operation. The same is used in checking interactively the consistency between class and operation specification models.

cc defines C/C++ format, pas defines Pascal format, ada defines Ada format, std defines standard natural English like specification language.

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7.4.4 Utilities page of Prosa Configuration

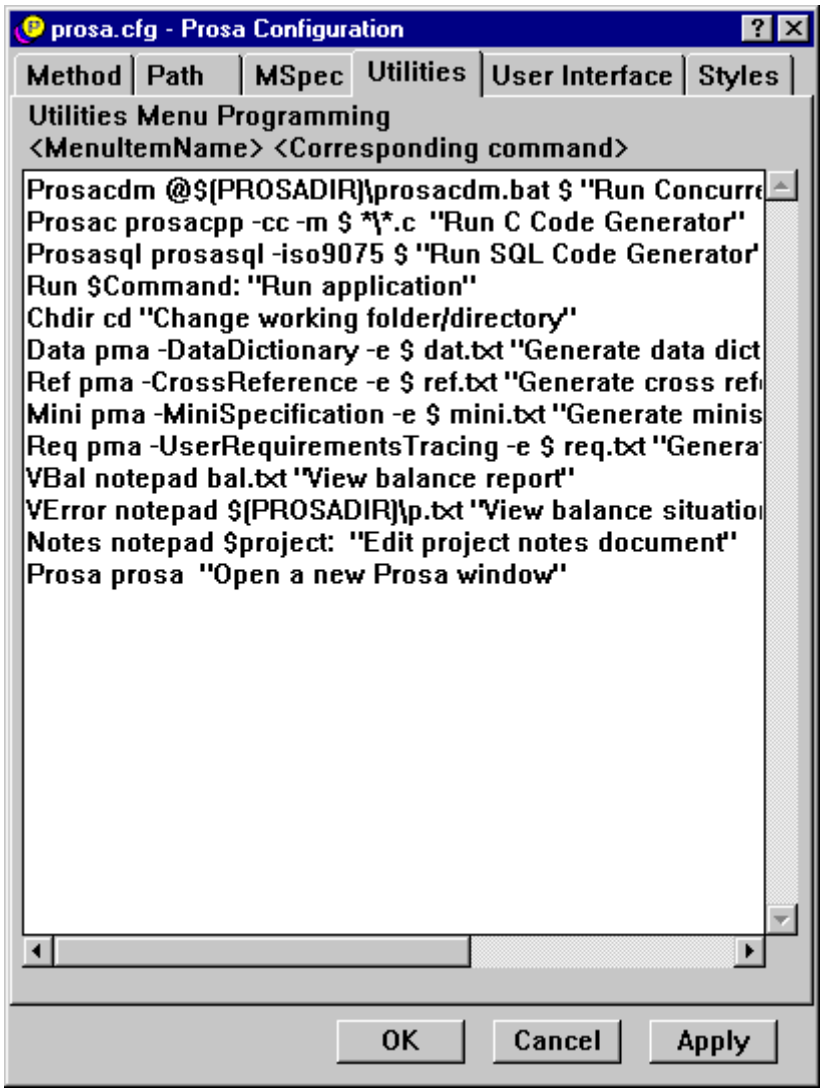
prosa.cfg - Prosa Configuration
Method
Path
MSpec
Utilities
User Interface
Styles
Utilities Menu Programming
<MenuItemName> <Corresponding command>
Prosacdm @$(PROSADIR)\prosacdm.bat $ "Run Concurre
Prosac prosacpp -cc -m $ **.c "Run C Code Generator"
Prosasql prosasql -iso9075 $ "Run SQL Code Generator"
Run $Command: "Run application"
Chdir cd "Change working folder/directory"
Data pma -DataDictionary -e $ dat.txt "Generate data dict
Ref pma -CrossReference -e $ ref.txt "Generate cross ref
Mini pma -MiniSpecification -e $ mini.txt "Generate minis
Req pma -UserRequirementsTracing -e $ req.txt "Genera
VBal notepad bal.txt "View balance report"
VError notepad $(PROSADIR)\p.txt "View balance situatio
Notes notepad $project: "Edit project notes document"
Prosa prosa "Open a new Prosa window"
OK
Cancel
Apply

Figure 7.12 Utilities page.

7.4.4.1 Utilities Menu programming

The Utilities -menu of Prosa -window can be programmed by the user through Utilities configuration page. Each entry in Utilities menu definition consists of menu item name, corresponding command and optional status-bar help text, all in a single line. The '$' character in the command section is used as a placeholder for the model name currently in Prosa -window.

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7.4.4.2 Utilities Menu example

Prosac prosacpp -cc -m $ **.c "Run C Code Generator"

Prosac = Menu item
prosacpp –cc –m = Command and command options
$ = Placeholder for the model name
**.c = Output file definition
"Run C Code Generator" = Statusbar Help text

7.4.5 User interface page of Prosa Configuration

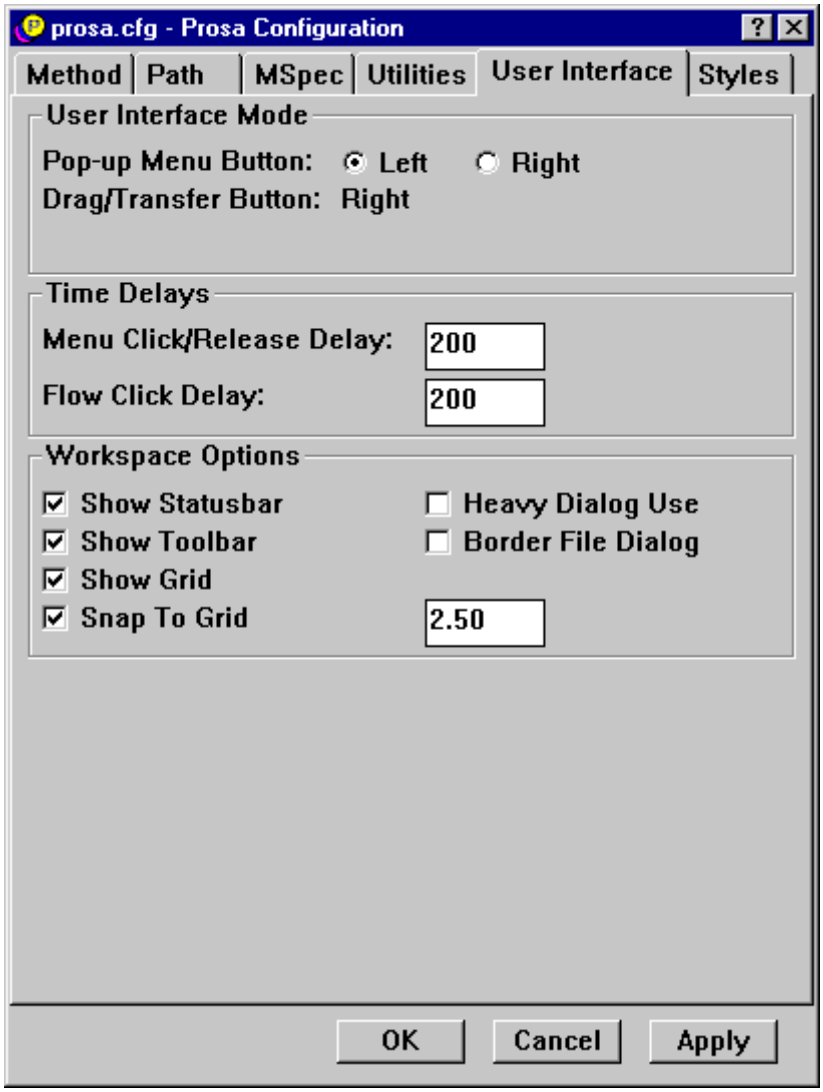

Figure 7.13 User Interface page.

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7.4.5.1 User Interface Mode

Pop-up menus of Prosa can be activated either by Left (default) or Right mouse button. Correspondingly the other button is used in dragging and moving modeling symbols and symbol names.

7.4.5.2 Time Delays

Menu Click/Release Delay. Pop-up menus can be activated by two ways. 1. Press the mouse button down and while holding the button down drag the mouse to desired menu item and make the selection by releasing the button, or 2. Click the mouse button fast to bring the menu permanently visible. Make the selection with another click. Menu Click/Release Delay defines the time (in milliseconds) how fast you must click to achieve the situation of method 2.

Flow Click Delay. In association, flow and transition generation, fast click creates a corner or bending point. Flow Click Delay defines the time (in milliseconds) how fast you must click to create a corner point. If this delay expires, a flow submenu is shown to direct you further.

7.4.5.3 Workspace Options

You can hide or show Statusbar, Toolbar and Grid. Snap to Grid, when enabled, allows symbol placement and association/transition generation only in the grid. In text editing field the size of grid can be defined (in millimeters, e.g 2.50).

Heavy Dialog Use shows frequently filename dialogs when traversing between various diagrams in a certain model.

Border File Dialog shows the dialog for reading prefilled diagram as a basis for a new model in Prosa Push to operation model or child data flow diagram.

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7.4.6 Styles page of Prosa Configuration

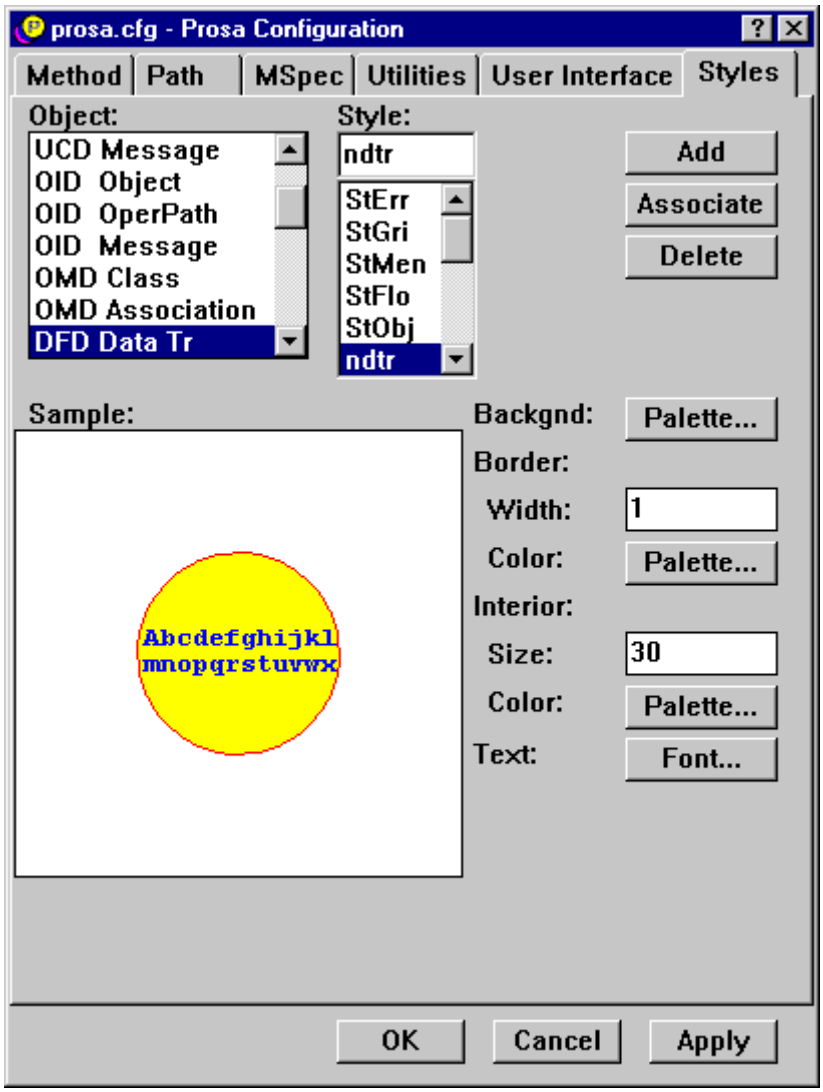

Figure 7.14 Styles page.

7.4.6.1 Editing an existing style

All but standard styles StFlo and StObj can be edited. Select first a modeling object from Object -listbox. Prosa automatically shows the corresponding style in Style -listbox. If that style is StFlo or StObj -style, to get an editable style you must create a new style for the selected object (see below). Otherwise you can edit the style by using the functionality offered by the Styles dialog.

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7.4.6.2 Defining a new style

Select first a modeling object from Object -listbox. If this style is editable, continue as advised above. Otherwise enter the new style name in the edit field of the Style -combobox. Press the Add button. Prosa inserts and highlights the new style in Style listbox. Now you can edit the style by using the functionality offered by the Styles dialog.

After the new style has been designed, you must associate the selected object and the newly created style by pressing the Associate -button.

7.4.6.3 Border Width and Interior Size Edit Fields

In order the changes to take effect, press the left button in a sample window.

7.4.6.4 Background, Border and Interior Color Dialogs

Press the Palette button. Select color and Press OK in color dialog to see the effect in the sample window. To accept the color, close the color dialog (through dialog's system menu's close selection).

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8. CREATING SA/SD/RT DIAGRAMS

8.1 User interface

Start Prosa by clicking on Prosa icon or by typing the command prosa.

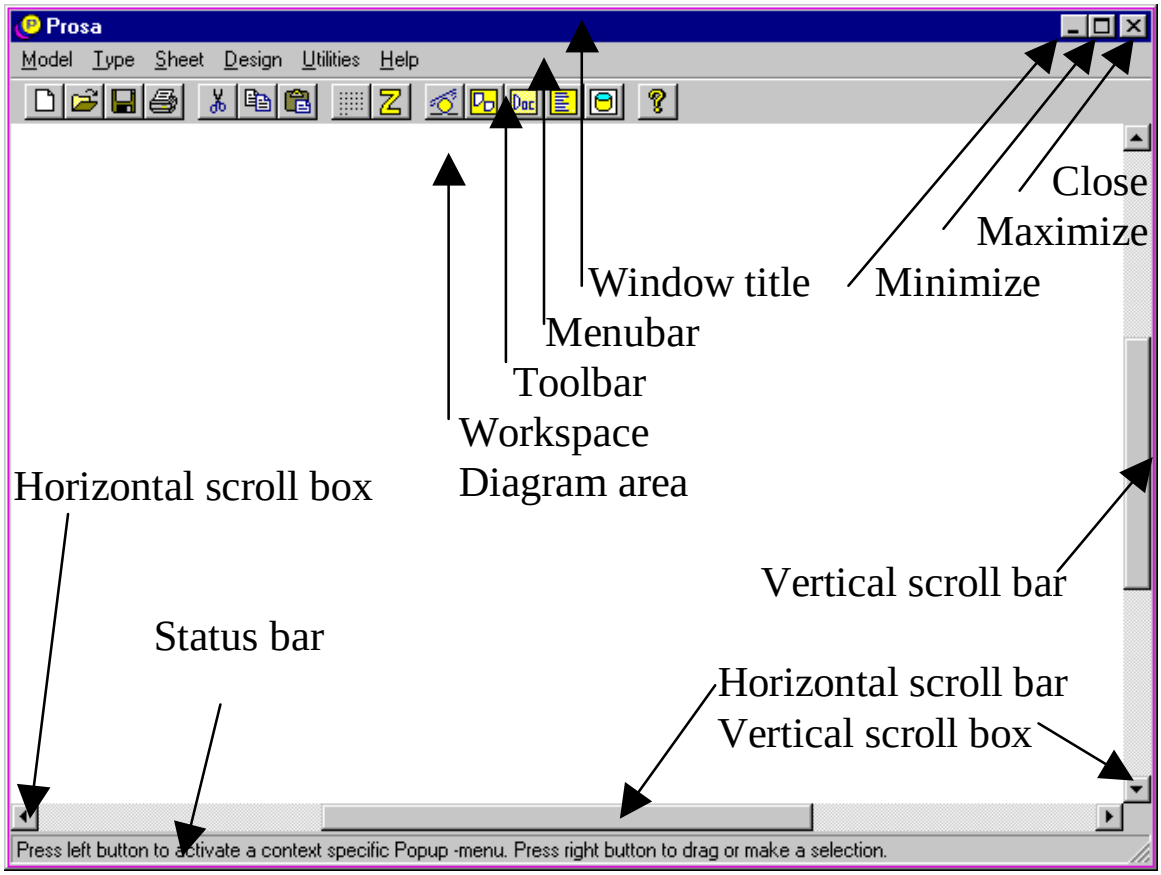

Figure 8.1 Prosa window.

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8.1.1 Command button

Prosa/sa can be controlled with a single mouse button.

Command button is the left button by default. The second button (drag button) is optional and can be used if desired.

The command button is used to activate menus. The pull-down menus in the menu bar of the Prosa/sa window are activated with the command button. The context sensitive menus in the diagram or client area are activated with the command button.

When a command has been selected, the same button can be used to bring the selected function or operation to the successful end.

8.1.2 Drag button

Drag button is the right button by default. The use of drag button is optional.

With drag button you can attach to symbols and texts and change their position. Drag button can be used to initiate a selection of a diagram area for copy or deletion.

All these operations can be done also with command button through menus. Thus the drag button is available for activating certain default functions without a menu selection.

8.1.3 Command/drag button programming

You can swap the button definitions through **Config** selection in the **Design** menu. Select the **User Interface** -page in the configuration dialog.

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8.2 Changing working directory

Create folder/directory demo. Select Chdir from Utilities menu. Change the default directory to demo.

8.3 Environment model

8.3.1 Context diagram

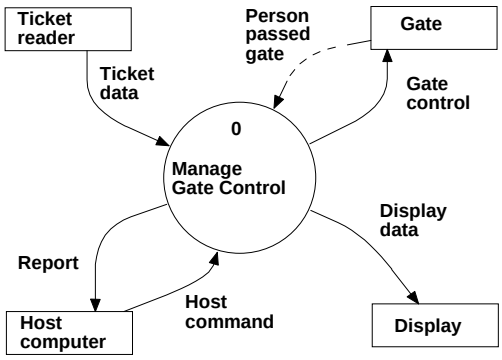

Figure 8.2 Context diagram.

1. *Select **Datatr** from workspace menu.*
2. *Symbol menu is activated by pointing the symbol and holding the button down.*
3. *Set **Number** and **Name** of the data transformation.*
4. *Select **Terminator** from workspace menu. Name it.*

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5. *A flow is drawn from source to destination. Use flow type **Discr Data**.*
   - Bending point is made by fast click.
   - Flow is terminated by pointing the destination and clicking.
6. *Scroll down the Prosa window to find the Title block. Fill in:*
   Author, Project and Title fields.
7. *Save the diagram **dgate.dfd** by selecting **Save As...** from **Model** menu.*

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8.3.2 Event list

Point the data transformation and select **Property**.

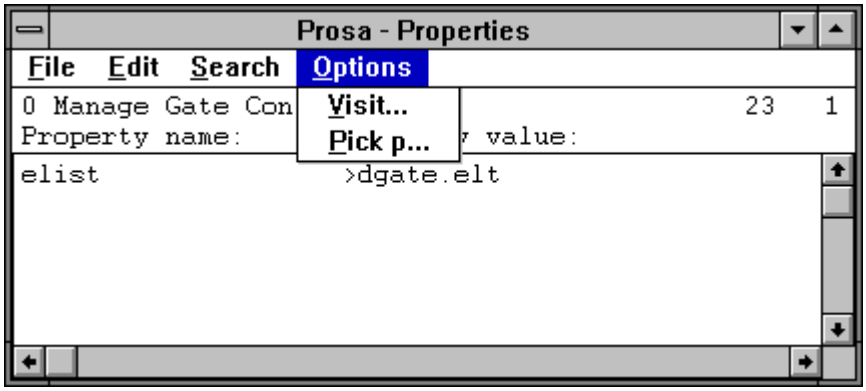

Figure 8.3 Opening event list.

1. Type property name **elist**.
2. Enter **tab** to separate name and value field.
3. Type property value **>dgate.elt**.
   - The > -character states that the value is file name.
4. Select **Visit...** from **Options** menu.
5. Your text editor is started and you can type the event list.
6. Type some events in the event list.
7. Close the text editor.

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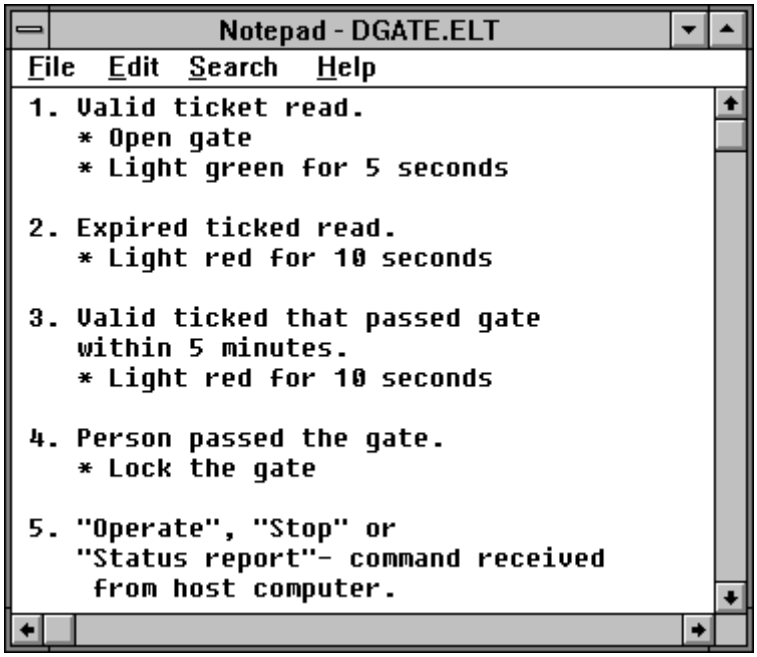
Notepad - DGATE.ELT
File Edit Search Help
1. Valid ticket read.
* Open gate
* Light green for 5 seconds
2. Expired ticked read.
* Light red for 10 seconds
3. Valid ticked that passed gate
within 5 minutes.
* Light red for 10 seconds
4. Person passed the gate.
* Lock the gate
5. "Operate", "Stop" or
"Status report"- command received
from host computer.

Figure 8.4 Event list.

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8.4 Behavioural model

8.4.1 Data flow diagram

1. *Point data transformation of the context diagram and select **Push**.*
2. *Give name **dgate0.dfd** for the child data flow diagram.*
3. *Save the context diagram when Prosa asks Save/Nosave.*
4. *Create the child diagram shown below.*

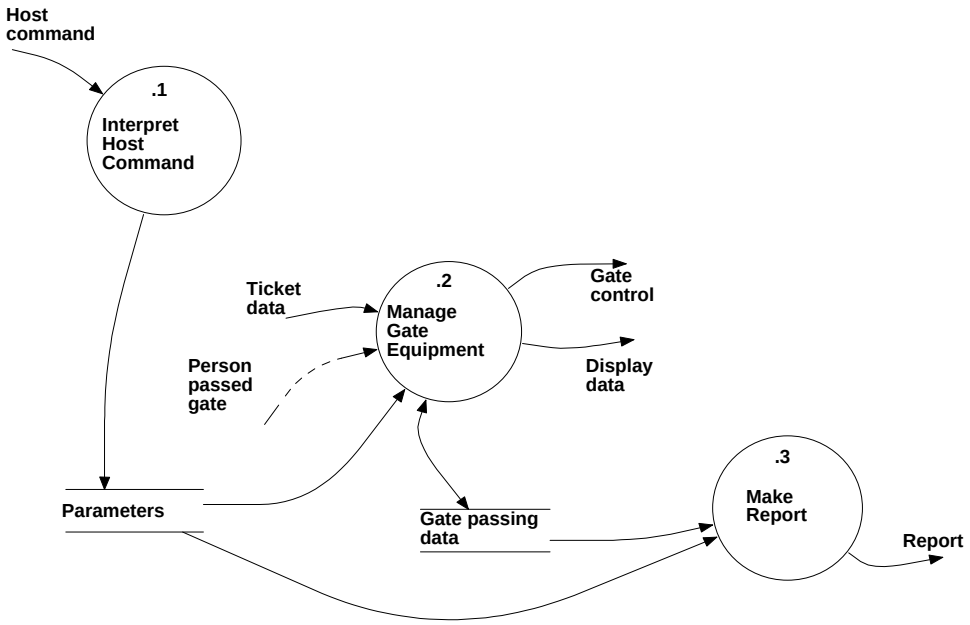

Figure 8.5 Data flow diagram.

5. *Place and name the data transformations first.*
6. *Flow stubs can be moved with **Move** selection from flow menu.*

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7. *Input flows are connected by attaching with **Modify** command to the arrowhead of the flow and terminating the flow to destination.*
8. *Output flows are connected by attaching with **Modify** command to the start point of the flow and routing it to source.*
9. *Finish the diagram shown above.*
10. *Train the termination of the flow to diagram area. Attach to the arrowhead of "Report" flow with modify command, move mouse, press and hold button down. Flow termination submenu appears, select **Finish** to terminate the flow to diagram area.*

8.4.2 Consistency checking between data flow diagrams

1. *Edit the flow "Host Command" to "xHost Command".*
2. *Select **Pop** from workspace menu to pop up to context diagram.*
   - Respond "Save" to Save/Nosave query.
3. *Select **Push** from data transformation menu to push back into child data flow diagram.*
4. *Prosa indicates an error in unmatched child flow "xHost Command". Error is indicated by showing the name with special color.*
   - *The error color can be configured through presentation styles.*

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5. *Fix the error by removing 'x'.*
6. *Perform **Pop** and add extra flow in the context diagram.*
7. *Perform **Push** and notice how Prosa brings new input flows in the upper left corner and output flows in the upper right corner of the sheet.*

8.4.3 Adding control to data flow diagram

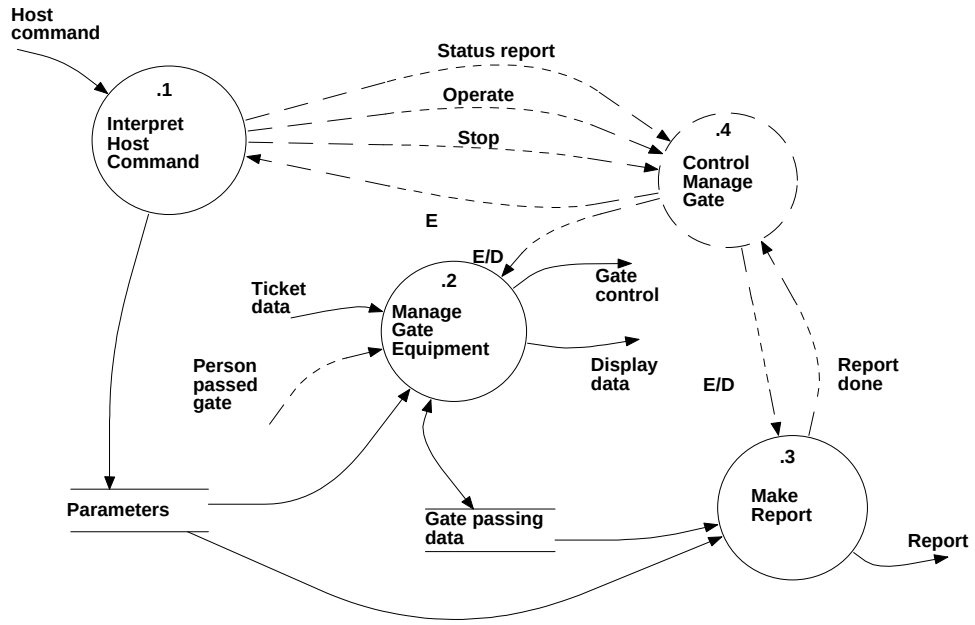

Figure 8.6 Data flow diagram with control.

1. *Select **Control Tr** from workspace menu.*
2. *Place control transformation as shown.*
3. *Make connections indicated above.*

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8.4.4 State transition diagram

1. *Select **Push** from the control transformation menu of the previous child data flow diagram.*
2. *Give the name **sgate0.std** for std model file.*
3. *Save the data flow diagram.*
4. *Notice that Prosa has changed the workspace menu to state transition diagram menu.*

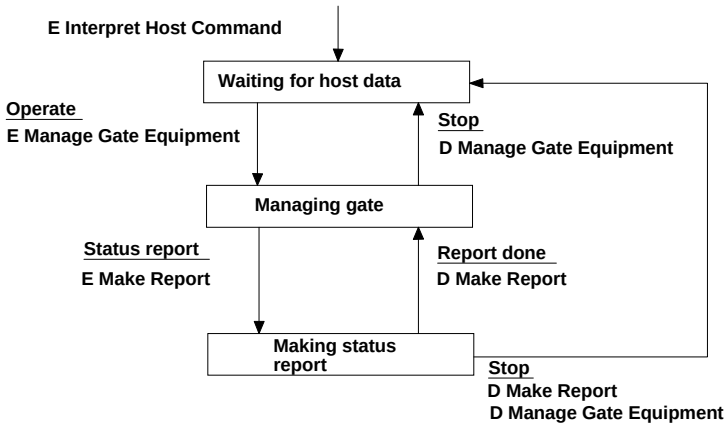

Figure 8.7 State transition diagram.

5. *Place and name states.*
6. *Draw initial transition.*
7. *Point transition and Select **Pick a** (Pick action) from transition menu.*
   - First group of items in Pick Box shows available conditions.
   - Second group shows available actions.

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- Third group shows local variables declared in std (if any).

8. *Pick and place action for initial transition.*
9. *Route all transitions and place conditions/actions with **Pick c/Pick a** selections in transition menu.*
   - Be careful to open the transition menu above that transition where you want to add condition/action to maintain the logical relation between text and transition arrow.

8.4.5 Consistency checking between dfd and std

1. *Open diagram **sgate0.std**.*
2. *Edit condition "Operate" to "xOperate".*
3. *Add extra action "E Process1":*
   *- Select **Action** from transition menu.*
   - Point to the <new> token, click button and type the action name.
4. *Select **Pop** from workspace menu to Pop to dfd. **Save** the std.*
5. *Select **Push** from control transformation menu.*
6. *Notice the indication of unmatched condition and action.*
7. *Select **Pick c** from transition menu. Notice the 'M' character in front of "Operate" condition item in the Pick Box. 'M' denotes missing item.*

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8.4.6 Hierarchical data flow diagram design

1. *Open diagram **dgate0.dfd**.*
2. *Make **Push** into "Make Report" data transformation.*
3. *Give name **dmreport.dfd** to the child file.*
4. *Create the diagram shown below for the functional refinement of "Make Report" data transformation.*

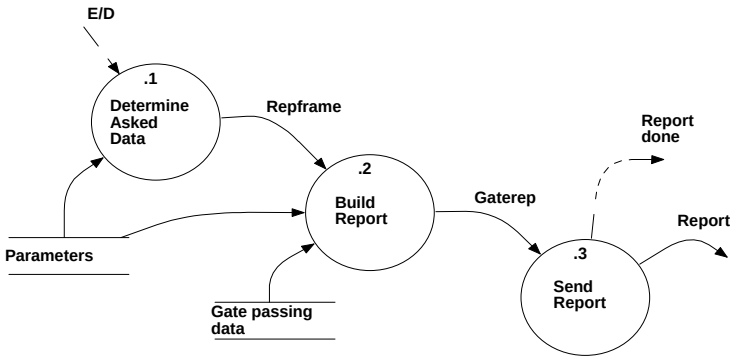

Figure 8.8 Data flow diagram (1 -level).

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8.4.7 Minispecification design

1. *Minispecification design will be done once we have learned data dictionary and data modeling.*
2. *Open the diagram **dmreport.dfd**.*
3. *Point the flow "Repframe", select **Define** and type definition repfrtype.*
4. *Point the flow "Gaterep", select **Define** and type definition gatereptype.*
5. *Make **Push** into "Build Report" data transformation.*
6. *Give name **cbreport.c** for the child file.*
7. *Let Prosa create new minispecification file and show the minispecification header in your text editor.*

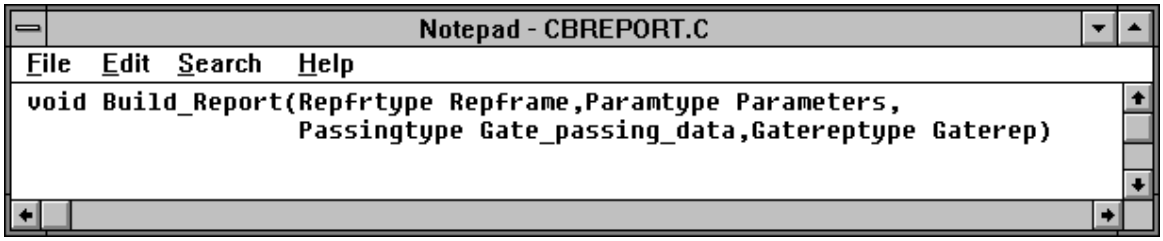

Figure 8.9 Automatically generated minispecification header.

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8.4.8 Consistency checking between dfd and minispecification

1. *Change the type "Repfrtype" to "xrepfrtype" in minispecification file **cbreport.c**.*
2. *Save and close minispecification.*
3. *Make **Push** into "Build Report".*
   - Prosa shows in Advice Window that there are balancing errors in the minispecification.
4. *Select **Verror** from **Utilities** menu of Prosa window.*
   - Prosa shows the reason for imbalance in your text editor.
   - The error log is written in text interface file p.txt.
5. *Fix the error in minispecification and close the text editor.*

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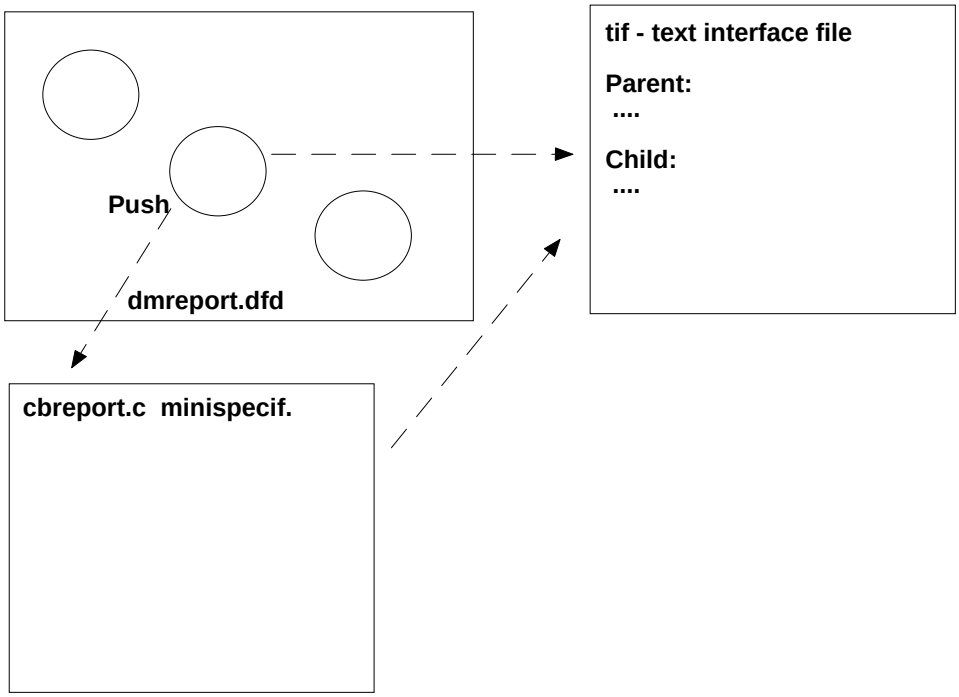

DURING MINISPECIFICATION PUSH PROSA CHECKS THE CONSISTENCY BETWEEN THE HEADER GENERATED FROM DATA FLOW DIAGRAM AND THE HEADER FOUND FROM MINISPECIFICATION FILE.

THE HEADERS AND POSSIBLE ERROR LOG ARE WRITTEN TO TEXT INTERFACE FILE TIF. THE TIF FILENAME IS DEFINED IN PATH SECTION OF PROSA.CFG FILE.

THE TIF FILE CAN BE VIEWED WITH VERROR (VTIF) SELECTION OF UTILITIES MENU.

Figure 8.10 Error reporting arrangement during minispecification Push.

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9. DATA DICTIONARY

Data is defined in the module (diagram) where it is first used in a model hierarchy. If data modeling is used, data must be defined in data model (=entity relationship diagrams).

Data can be viewed anywhere where it is referenced. Data is inherited automatically from higher levels to lower levels and from entity relationship diagrams to data flow diagrams.

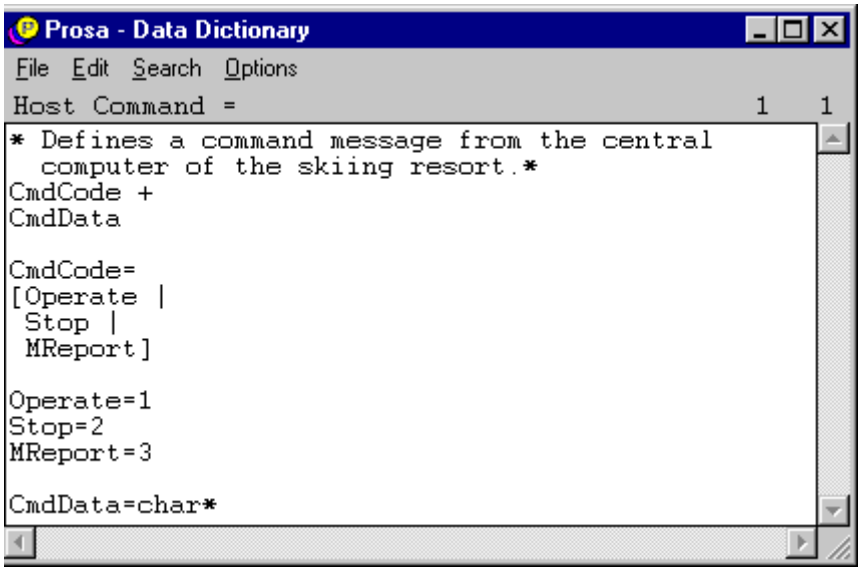

Figure 9.1 Data dictionary window.

1. *Open the diagram **dgate.dfd**.*
2. *Select **Define** from the menu of "Host Command" flow.*
3. *Enter the data dictionary definition as shown.*
4. *Close the data dictionary window.*
5. *Make **Push** into child data flow diagram.*
6. *Select **Define** from the menu of "Host Command" flow.*

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7. *Notice that data dictionary window is now in View-mode.*
8. *Select **Visit** from the **Options** menu of data dictionary window.*

9 *Prosa reads the diagram dgate.dfd where "Host Command" has been defined and the definition can be edited.*

10. *Select **Return** from the **Design** menu of Prosa window.*

    - Prosa brings you back to the diagram where visit was made.

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10. DATA MODELING

10.1 Creating entity relationship diagrams

1. *Select **New** from the **Model** menu of Prosa window.*
   - Save the current diagram.
2. *Select **ERD** from the **Type** menu of Prosa window.*
3. *Create the **erd** diagram show below and enter definition for the entity "Gate passing data".*
   - If data models are designed, data entities must be defined in data model. The definitions are automatically inherited to behavioural model.
4. ***Save** the diagram with the name **egate.erd**.*

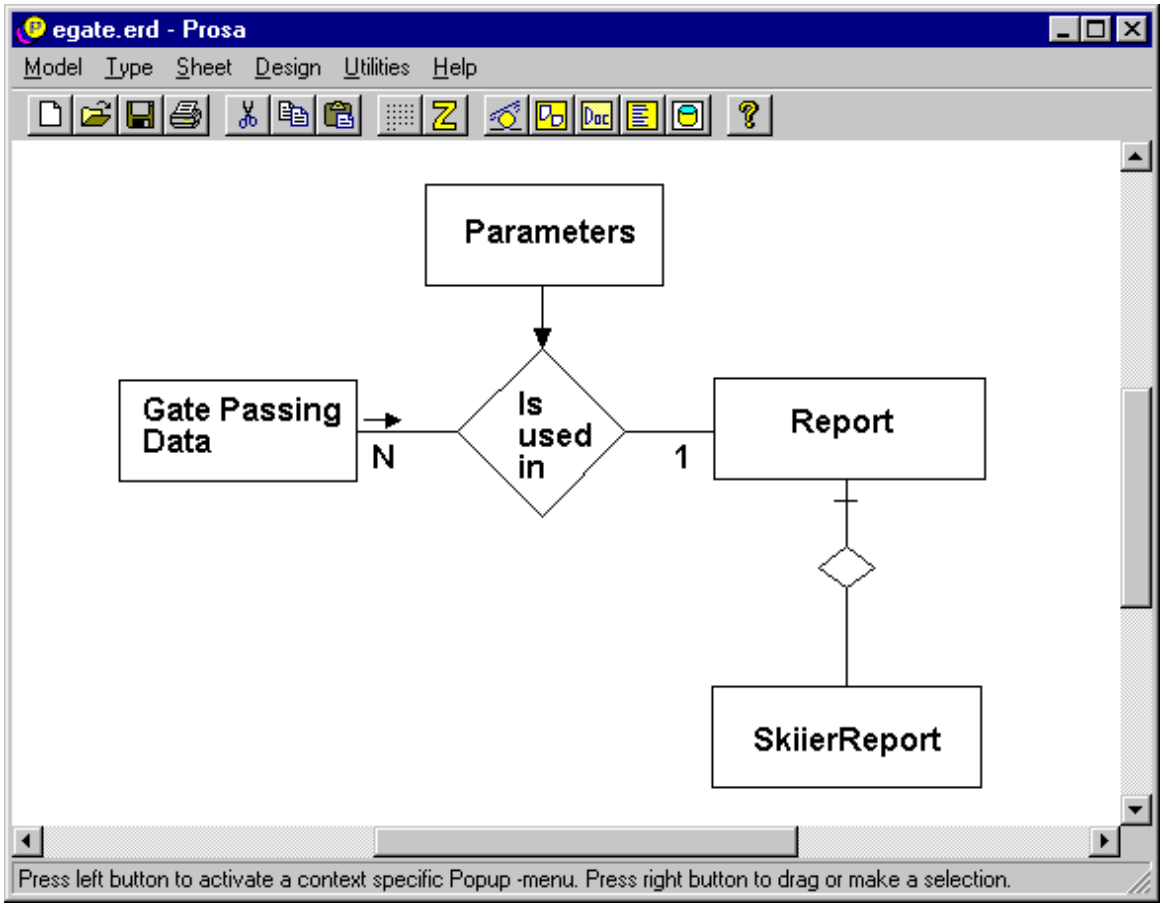

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Figure 10.1 Entity relationship diagram.

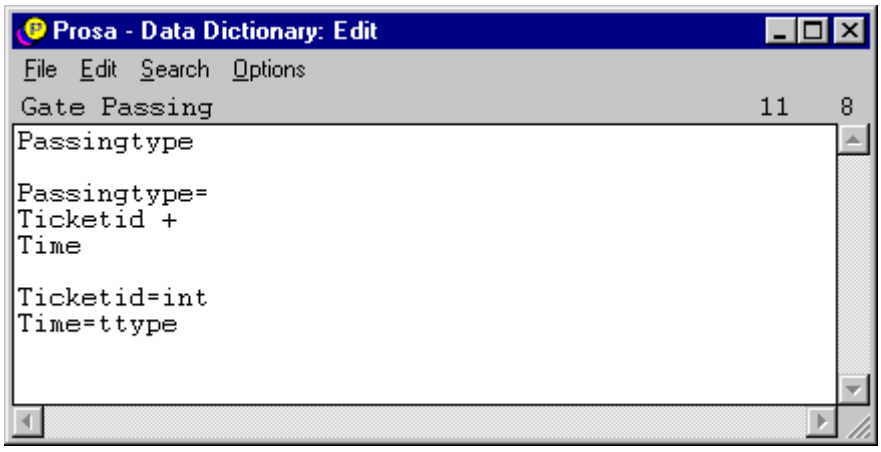

Figure 10.2 Entity definition.

10.2 Integrating data model and context diagram

1. *Select **Previous** from the workspace menu.*
2. *Pick the model **dgate.dfd** from **Files** listbox of Open dialog.*

   *- Save the current diagram (**egate.erd**).*

   - Prosa enters in dgate.dfd.
3. *Save dgate.dfd.*
4. *Select **Property** from the **Sheet** menu of Prosa window.*
   *- Notice the data model integration property **syspddo** (**s**ystem **p**roperty **d**ata **d**ictionary **o**rigin) which points to **egate.erd** data model.*
   - Close the Property window.
5. *Make **Push** to enter in child dfd from dgate.dfd.*
6. *Select **Define** from the menu of data store **Gate passing data**.*

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7. *Notice that data dictionary window is in View-mode.*
   *- Select **Visit** from the **Options** menu of dd window.*
   *- Prosa takes you to **egate.erd** where Gate passing data can be edited.*
8. *Select **Return** from the **Design** menu of Prosa window.*
   - Prosa brings you back to dgate0.dfd where visit originated.

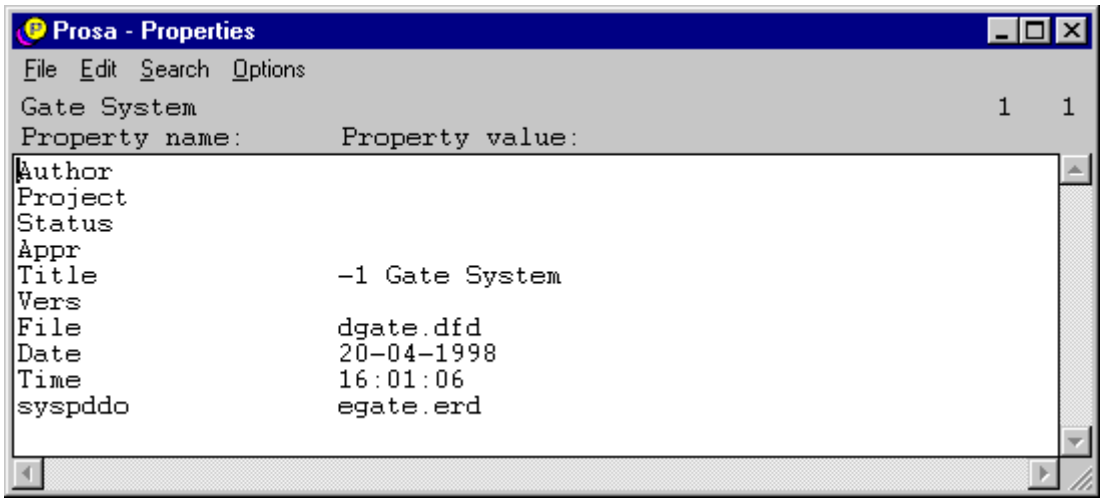

Figure 10.3 Sheet property "syspddo" of the context diagram points to data model

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10.3 Integration of multipage data models and context diagram

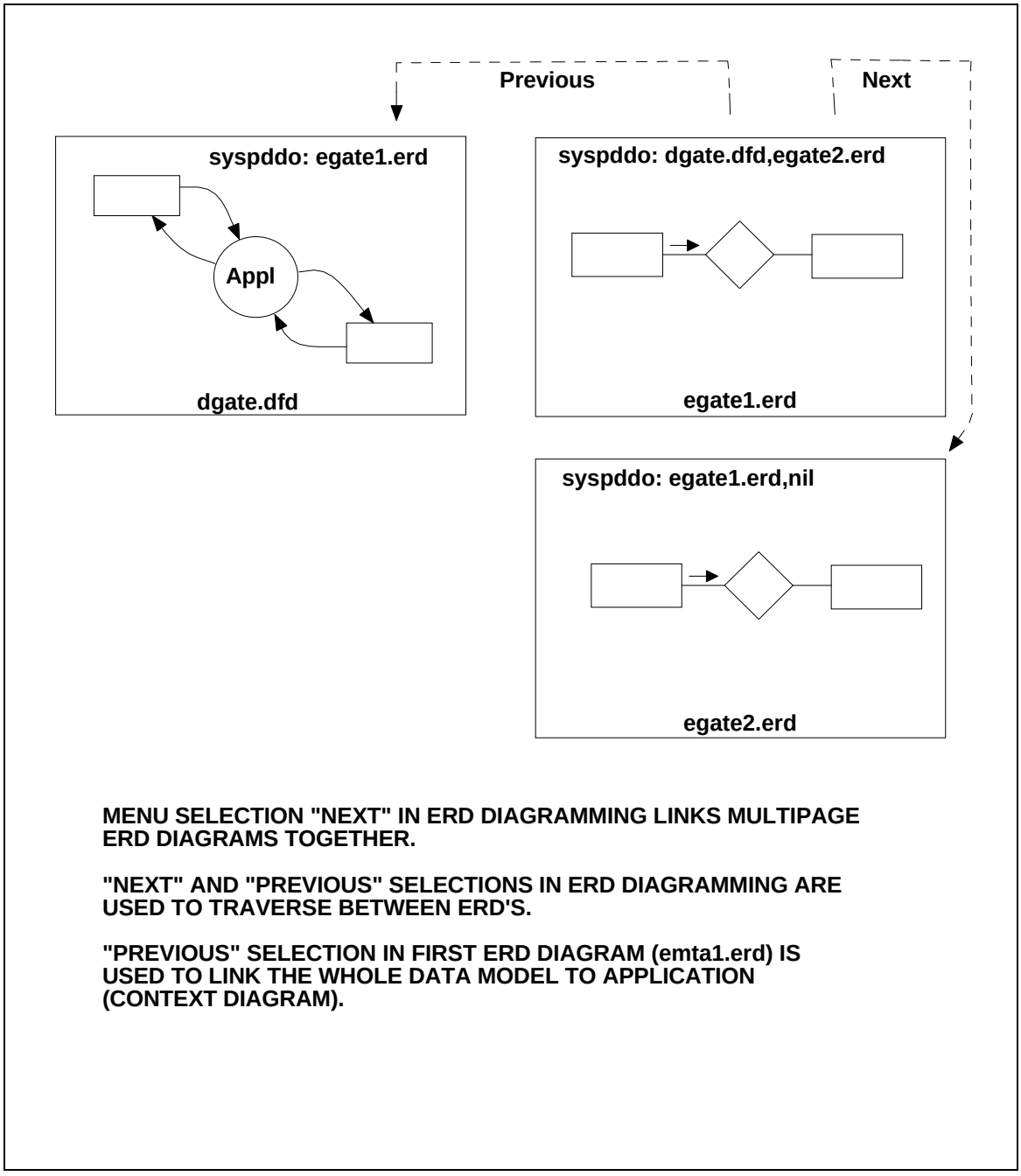
Previous
Next
syspddo: egate1.erd
Appl
dgate.dfd
syspddo: dgate.dfd,egate2.erd
egate1.erd
syspddo: egate1.erd,nil
egate2.erd
MENU SELECTION "NEXT" IN ERD DIAGRAMMING LINKS MULTIPAGE ERD DIAGRAMS TOGETHER.
"NEXT" AND "PREVIOUS" SELECTIONS IN ERD DIAGRAMMING ARE USED TO TRAVERSE BETWEEN ERD'S.
"PREVIOUS" SELECTION IN FIRST ERD DIAGRAM (emta1.erd) IS USED TO LINK THE WHOLE DATA MODEL TO APPLICATION (CONTEXT DIAGRAM).

Figure 10.3 Multipage erd diagrams.

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11. SUMMARY: DIAGRAM INTEGRATION

Figure 11.1 summarizes the integration between various SA/SD/RT models.

Prosa manages diagram linking in Push/Pop and Next/Previous functions automatically. In standard configuration, once the link has been established Prosa does not prompt the link when changing diagram during Push/Pop or Next/Previous functions.

The Push/Pop and Next/Previous prompt dialog can be switched on by Heavy Dialog Use checkbox on in User Interface page of the Prosa configuration dialog.

The Push (child) link can also be edited by opening the Property window for the particular object. The link is internally stored as a syspfdn (system property file down) -property.

The Pop (parent) link can also be edited with **Property** selection from **Sheet** menu of the Prosa window. The link is internally stored as a syspfup (system property file up) -property.

The Next/Previous link (horizontal links between erd or class diagrams) can also be edited with **Property** selection from **Sheet** menu of the Prosa window. The link is internally stored as a syspddo (system property data dictionary origin) -property. If there are two link names, first is previous and second is next, single item denotes next link always.

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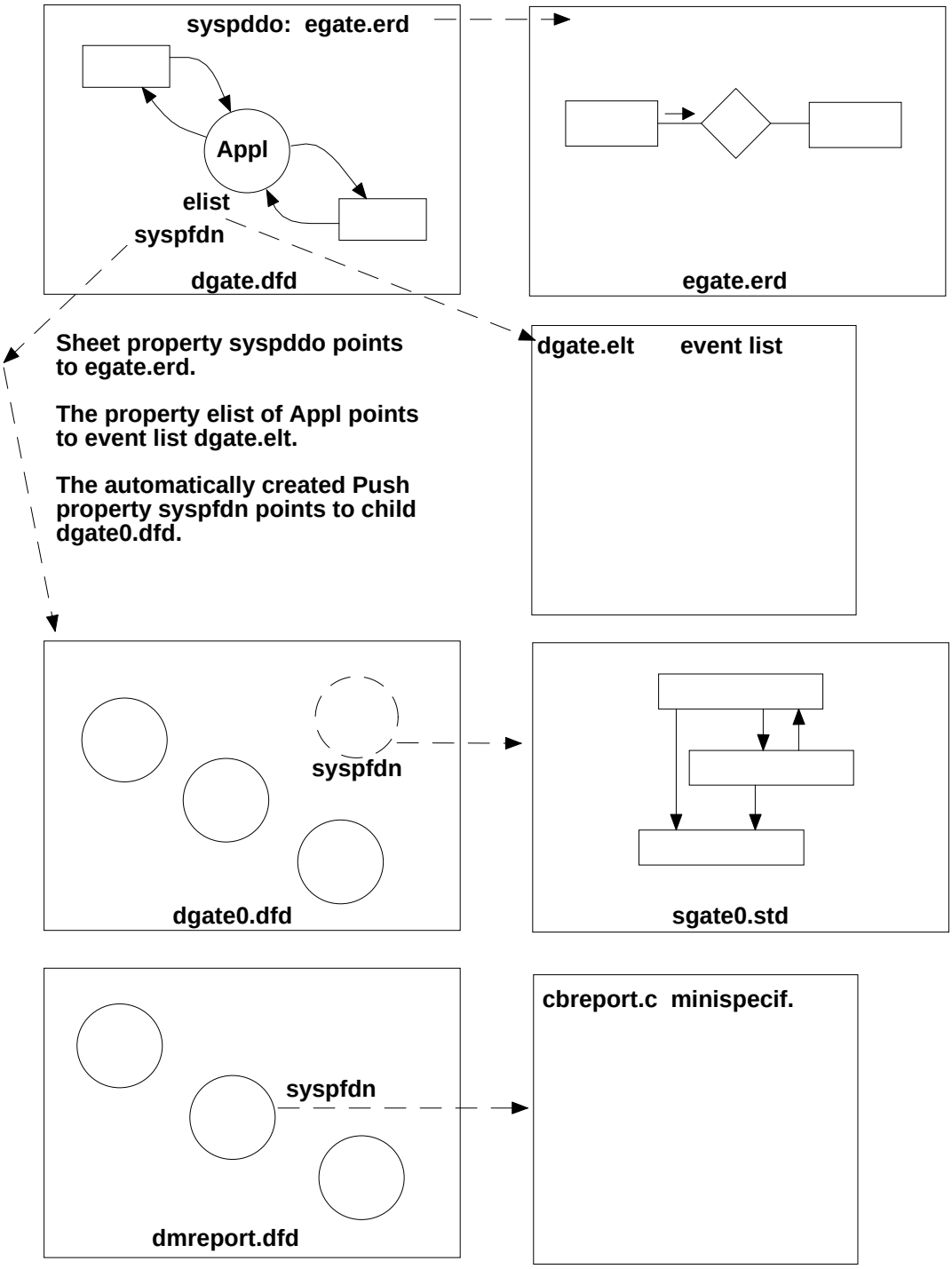

Figure 11.1 Diagram integration in Prosa Environment.

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12. BALANCE CHECKING IN BATCH MODE

Prosa checks the consistency between diagrams interactively during design. The consistency or balancing of the whole hierarchy of models can also be checked with a single command.

1. *Open the context diagram **dgate.dfd**.*
2. *Select **Balance** from **Design** menu of Prosa window.*

   - Click OK to accept balance report name.
   - Point the data transformation to start balancing.
   - Answer No to "Save diagrams during check?" question.

   (Yes would instruct Prosa to write error indications also in diagrams as they are shown in interactive checking.)

   - Prosa checks all diagrams and minispecifications in the model hierarchy and shows the result report in your text editor.

13. PRINTING DIAGRAMS

13.1 Standard printing

1. *Open the context diagram **dgate.dfd**.*
2. *Select **Print** from **Model** menu of Prosa window.*
   - Prosa prints the diagram with default print settings.

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13.2 Print dialog

Print Dlg... command in Model menu activates the printing dialog where you can interactively specify the printing parameters and then make the printing. If you want to change the printer used, you select Options command from Print dialog. The Help page can be opened by dragging the Help button (?-button) from the upper right corner of the dialog above a field or above a button.

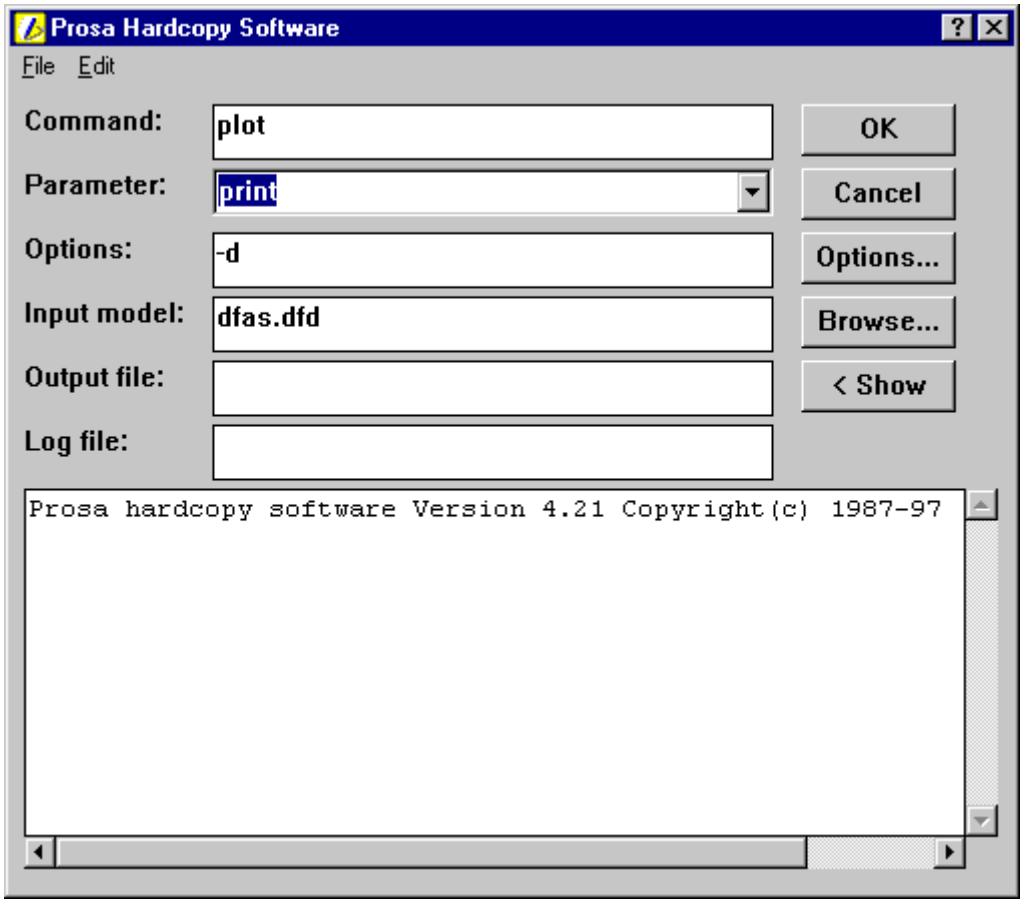

Figure13.1 Prosa Hardcopy Software dialog.

13.2.1 Print dialog menus

File menu contains Exit command, which closes the dialog. Edit menu contains Cut, Copy and Paste command for text editing in multiline text editor of Print dialog.

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13.2.2 Print dialog buttons

OK button starts printing. **Cancel** button closes the dialog and cancels printing.

Options... button activates the printer driver options dialog, see Figure13.2. Note that you must fill all other fields of Prosa Hardcopy Software dialog before pressing Options.

Browse... button can be used to browse the input model in the dialog. **Show** button can be used to show the contents of the ouput file in the text editor. If output file definition is wildcard, select (highlight) the unique filename in multiline text editor and press Show. Note that certain print formats are not viewable in text editor.

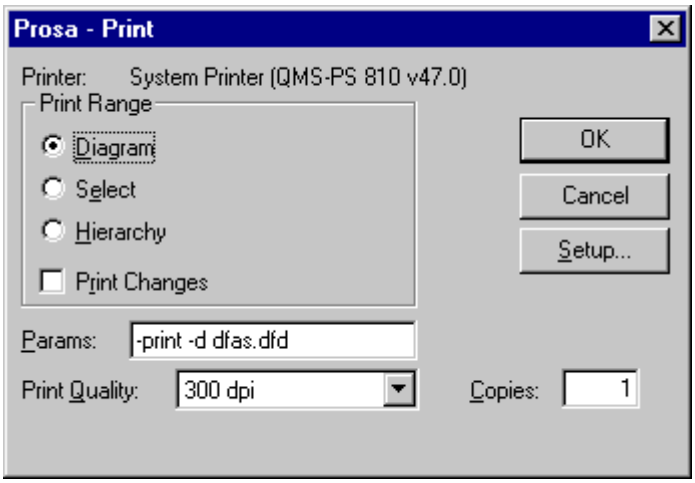

Figure13.2 Example print options dialog.

OK button starts printing, **Cancel** button returns you back to Prosa Hardcopy Software dialog, Setup button opens printer driver specific setup pages. In Print Range selections **Diagram** prints current model, **Select** allows to browse input models, **Hierarchy** prints current model and all child models. **Params** field contains the values collected from the Prosa Hardcopy Software dialog.

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Print Quality combobox contains printer driver specific resolution values.

13.2.3 Print dialog fields

13.2.3.1 Command

Command defines the name of the executable.

13.2.3.2 Parameter

Parameter defines hardcopy formatting record in the prosa.fmt file. The parameter combobox shows all pre-programmed hardcopy formats available in prosa.fmt. The standard delivery contains the following parameters:

print	Use Windows print driver, autorotate.
meta	Generate Windows Metafile Format (WMF).
metabw	Generate black and white WMF with no fills.
printrot0	Use Windows print driver, do not autorotate.

Only Unix users need the following parameters:

psa4	EPS, A4, autorotate.
psa4rot0	EPS, A4, no rotate.
psa4rot0t	EPS, A4, no rotate, to top of paper.
psa4rot0b	EPS, A4, no rotate, to bottom of paper.
psa4prot90l	EPS, A4 portrait, rotate 90, to left edge of paper.
psa4prot90r	EPS, A4 portrait, rot. 90, to right edge of paper.
hco ha4rot0	HPGL, A4, no rotate.
hco ha4prot0	HPGL, A4 portrait, no rotate.
hco ha4rot0_50	HPGL, A4, no rotate, scale 50%.
hco ha4prot0_50	HPGL, A4 portrait, no rotate, scale 50%.

Prosa Hardcopy Tool is user programmable. The programming occurs in prosa.fmt file. The programming commands have been presented in Prosa/sa User’s Manual Appendix C Programming Plot Tool.

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13.2.3.3 Options

Options field can have two option strings: **option sheetoption**, where option can consist of following switches:

- **a** Autoclip, i.e. clip empty sheet edges.
- **b** Drop border (sheet symbol).
- **c** Print changed diagrams only.
- **d** Show dialog always.
- **e** Show output file in text editor, see Show button above.
- **m** Produce prints for all diagrams of the model (hierarchy).
- **s** Select diagrams through select dialog

sheetoption can specify one of the following:

- **A4** Print A4 sheets only.
- **A4P** Print portrait A4 sheets only.
- **A3** Print A3 sheets only.

Examples: cm a4 , -cm -a4

Note: Use '-' (hyphen) in front of parameter, option and sheetoption in standard command line.

Example:

```
plot –print –m dfas.dfd
```

13.2.3.4 Input model

Input model defines the diagram where printing begins.

13.2.3.5 Output file

Output file definition is optional and can be a wildcard.

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13.2.3.6 Log file

Log file defines optional file where all output appearing in multiline editor is also written.

13.2.3.7 Message window

Message window presents information about the progress of the printing job.

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13.3 Print in Unix environment

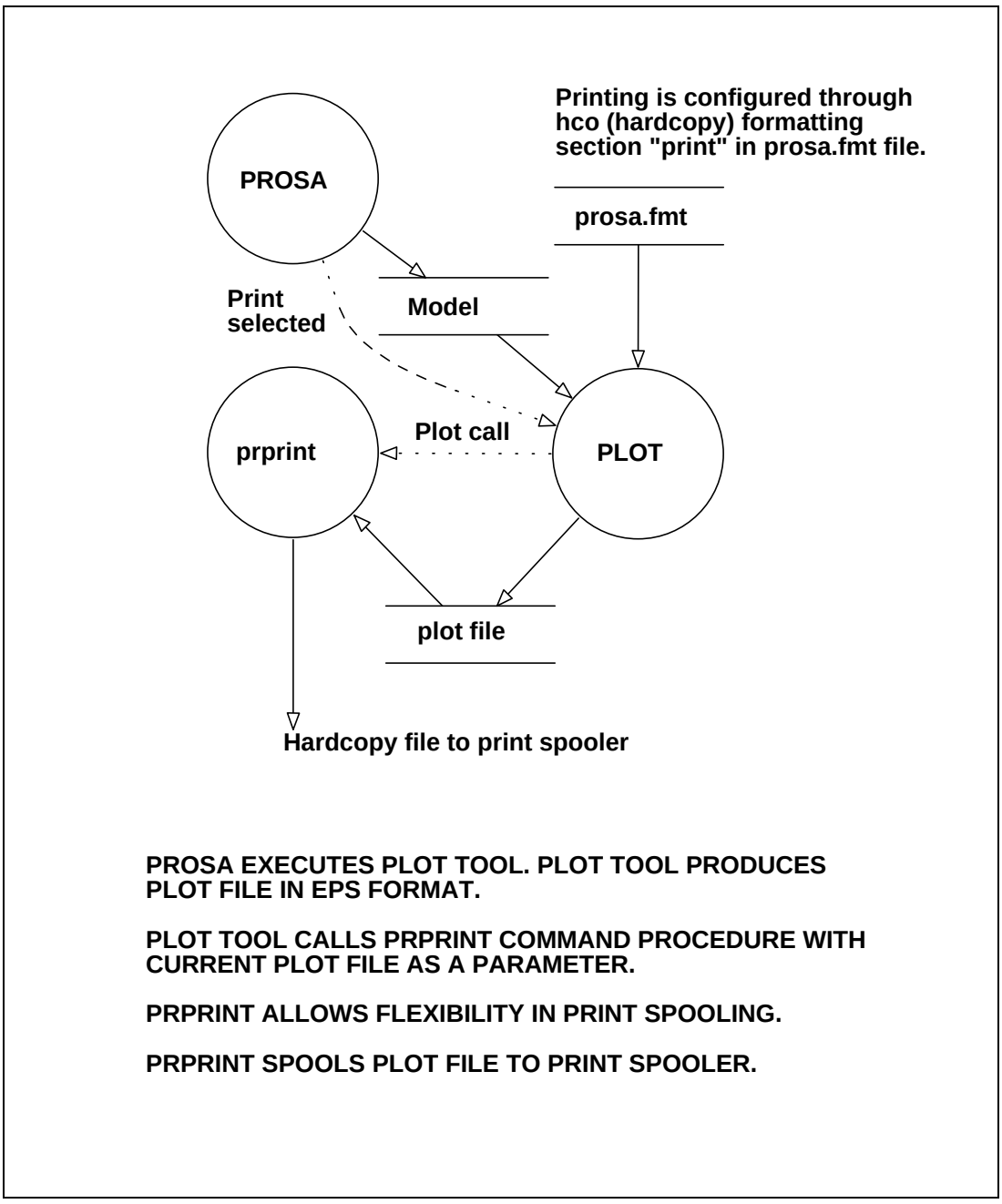
Printing is configured through hco (hardcopy) formatting section "print" in prosa.fmt file.
PROSA
prosa.fmt
Print selected
Model
prprint
Plot call
PLOT
plot file
Hardcopy file to print spooler
PROSA EXECUTES PLOT TOOL. PLOT TOOL PRODUCES PLOT FILE IN EPS FORMAT.
PLOT TOOL CALLS PRPRINT COMMAND PROCEDURE WITH CURRENT PLOT FILE AS A PARAMETER.
PRPRINT ALLOWS FLEXIBILITY IN PRINT SPOOLING.
PRPRINT SPOOLS PLOT FILE TO PRINT SPOOLER.

Figure 13.3 Print facility in UNIX and VMS.

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14. PROSA MODEL ANALYZER PMA TOOL

Prosa model analyzer PMA generates reports from Prosa's model data base. PMA tool contains with a set of pre-programmed analysis report types. In addition to standard reports, the user can create own analysis report types. The programming of new analysis report types has been presented in Prosa/sa User's Manual, Appendix D. Programming PMA Tool.

14.1 Making analysis reports

PMA tool can be started from Utilities menu (Data, Ref, Mini and Req items), from PMA icon in Prosa folder or from PMA button in Prosa/sa toolbar.

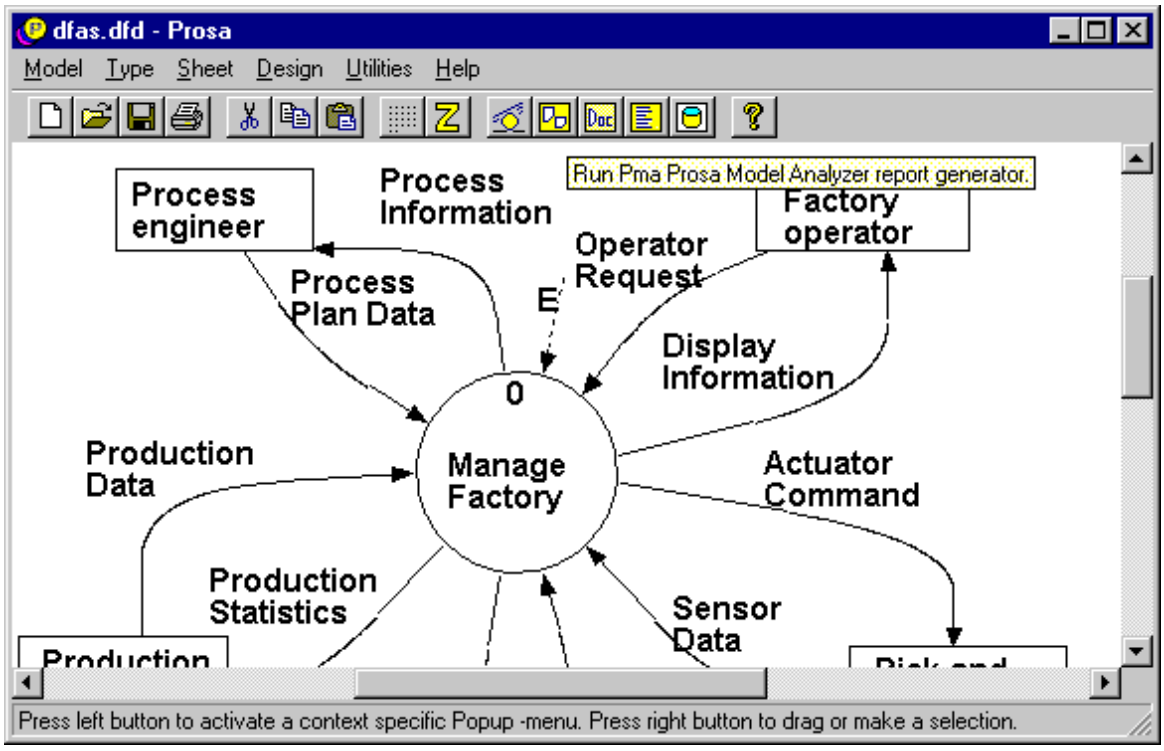

Figure14.1 Running PMA from Toolbar icon.

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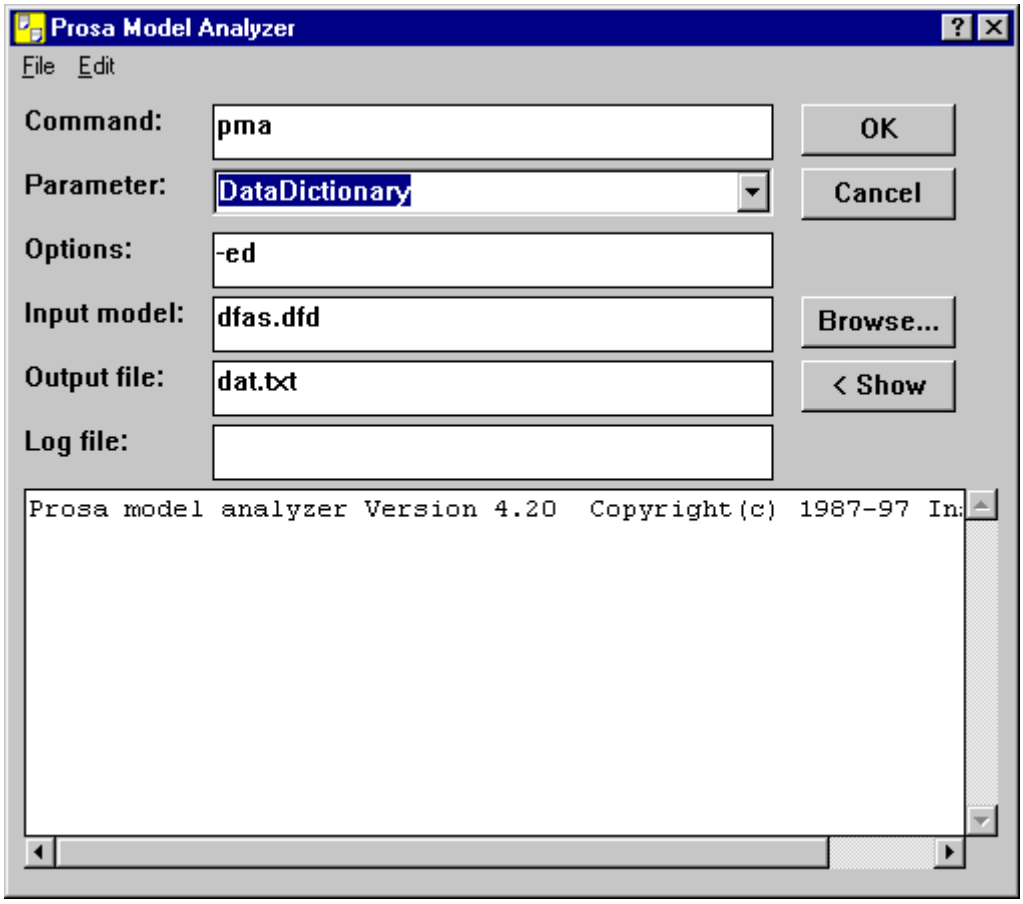

Figure14.2 Prosa Model Analyzer dialog.

14.2 PMA dialog menus

File menu contains Exit command, which closes the dialog. Edit menu contains Cut, Copy and Paste command for text editing in multiline text editor of PMA dialog.

14.3 PMA dialog buttons

OK button starts report generation. **Cancel** button closes the dialog and cancels reporting.

Browse... button can be used to browse the input model in the dialog. **Show** button can be used to show the generated report. In module based reports the output file definition is wildcard. Then

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select (highlight) the unique filename in multiline text editor and press Show.

14.4 PMA dialog fields

14.4.1 Command

Command defines the name of the executable.

14.4.2 Parameter

Parameter defines analysis report type. The parameter combobox shows all programmed reports available in prosa.fmt. Prosa/sa delivery contains the following standard report types:

DataDictionary	Data dictionary analysis.
CrossReference	Cross reference analysis.
MiniSpecification	Minispecification analysis.
UserRequirementsTracing	User requirements tracing analysis.
ProjectModelDatabase	Model data base analysis.
UndefinedData	Undefined data analysis.
PrimitiveData	Primitive data analysis.
ProjectAnalysis	Project analysis.
ModuleBasedData	Module based data dictionary analysis.
ModuleBasedRequirements	Module based requirements tracing analysis.

The user can create also own report types. The programming of new report types occurs in prosa.fmt file. The programming commands have been presented in Appendix D Programming PMA Tool.

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14.4.3 Options

Options can have the following switches:

- **d** Show dialog always.
- **e** Show output file in text editor, see Show button before.
- **g** Produce global report for the whole model (default)
- **m** Produce report module by module. This option requires Prosacdm licence.

Examples: d, dm, -d , -dm

Note: Use '-' (hyphen) in front of parameter and options fields in standard command line.

14.4.4 Input model

Input model defines the diagram where PMA reporting begins.

14.4.5 Output file

Output file defines report file.

14.4.6 Log file

Log file defines optional file where all output appearing in multiline editor is also written.

14.4.7 Message window

Message window presents information about the progress of the reporting.

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14.5 PMA command line syntax

You always run PMA tool from **Utilities** menu command, from toolbar, from PMA icon or through running **Prosacdm**. The command line parameters can be used to control the operation of the PMA tool. You can change the command line parameters by changing the parameters through Utilities page of Prosa configuration dialog or in the case of Prosacdm by changing the command line parameters in Prosacdm command file.

The PMA tool is executed by the command

- **pma** -parameter [-option] modelname reportname

Command line items correspond to dialog items presented above.

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14.6 Analysis report examples

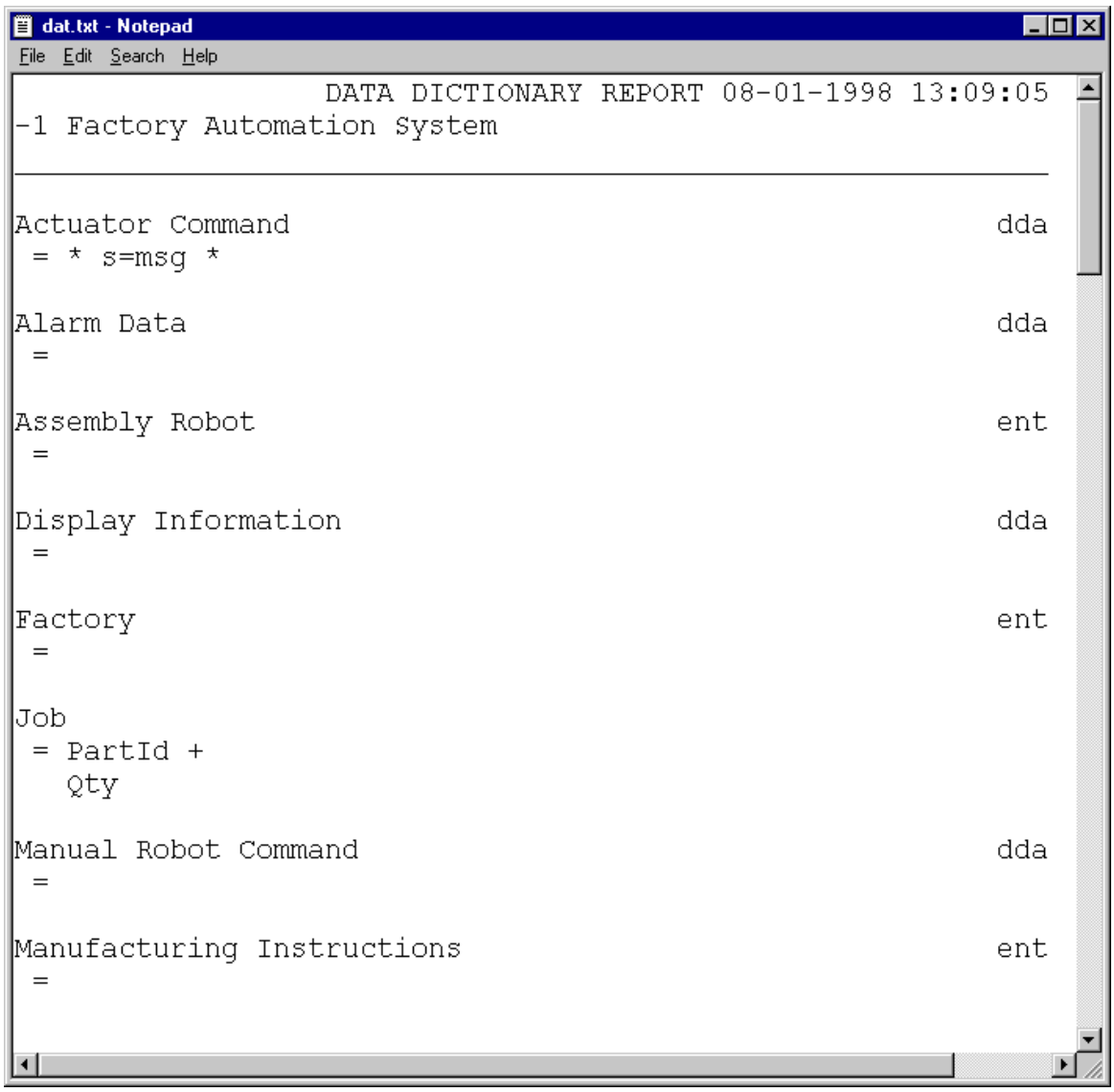

Figure 14.3 Data dictionary report (Parameter=DataDictionary; Options=-ed).

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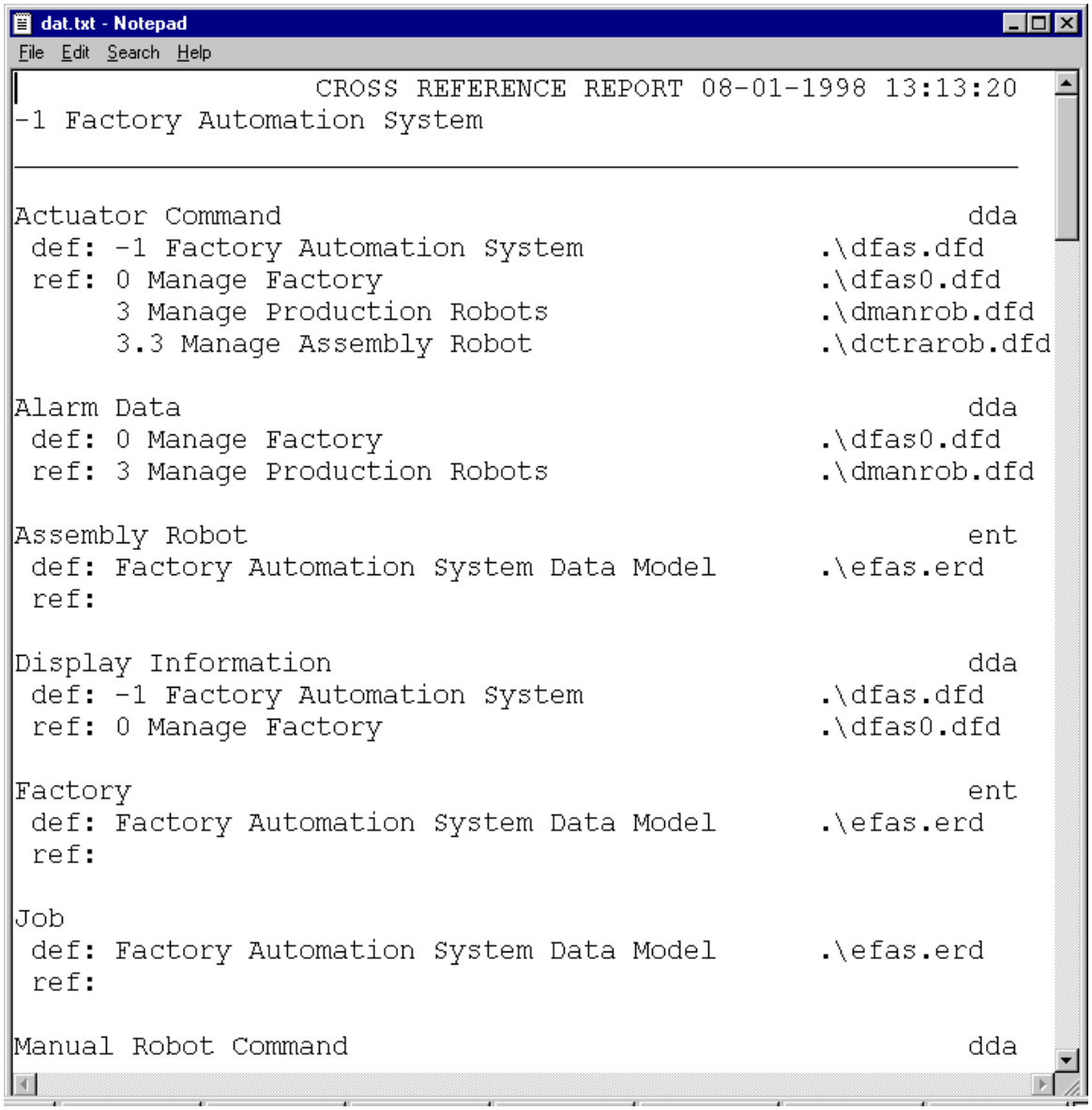
dat.txt - Notepad
File Edit Search Help
CROSS REFERENCE REPORT 08-01-1998 13:13:20
-1 Factory Automation System
Actuator Command dda
def: -1 Factory Automation System .\dfas.dfd
ref: 0 Manage Factory .\dfas0.dfd
3 Manage Production Robots .\dmanrob.dfd
3.3 Manage Assembly Robot .\dctrarob.dfd
Alarm Data dda
def: 0 Manage Factory .\dfas0.dfd
ref: 3 Manage Production Robots .\dmanrob.dfd
Assembly Robot ent
def: Factory Automation System Data Model .\efas.erd
ref:
Display Information dda
def: -1 Factory Automation System .\dfas.dfd
ref: 0 Manage Factory .\dfas0.dfd
Factory ent
def: Factory Automation System Data Model .\efas.erd
ref:
Job
def: Factory Automation System Data Model .\efas.erd
ref:
Manual Robot Command dda

Figure 14.4 Cross reference report (Parameter=CrossReference; Options=-ed).

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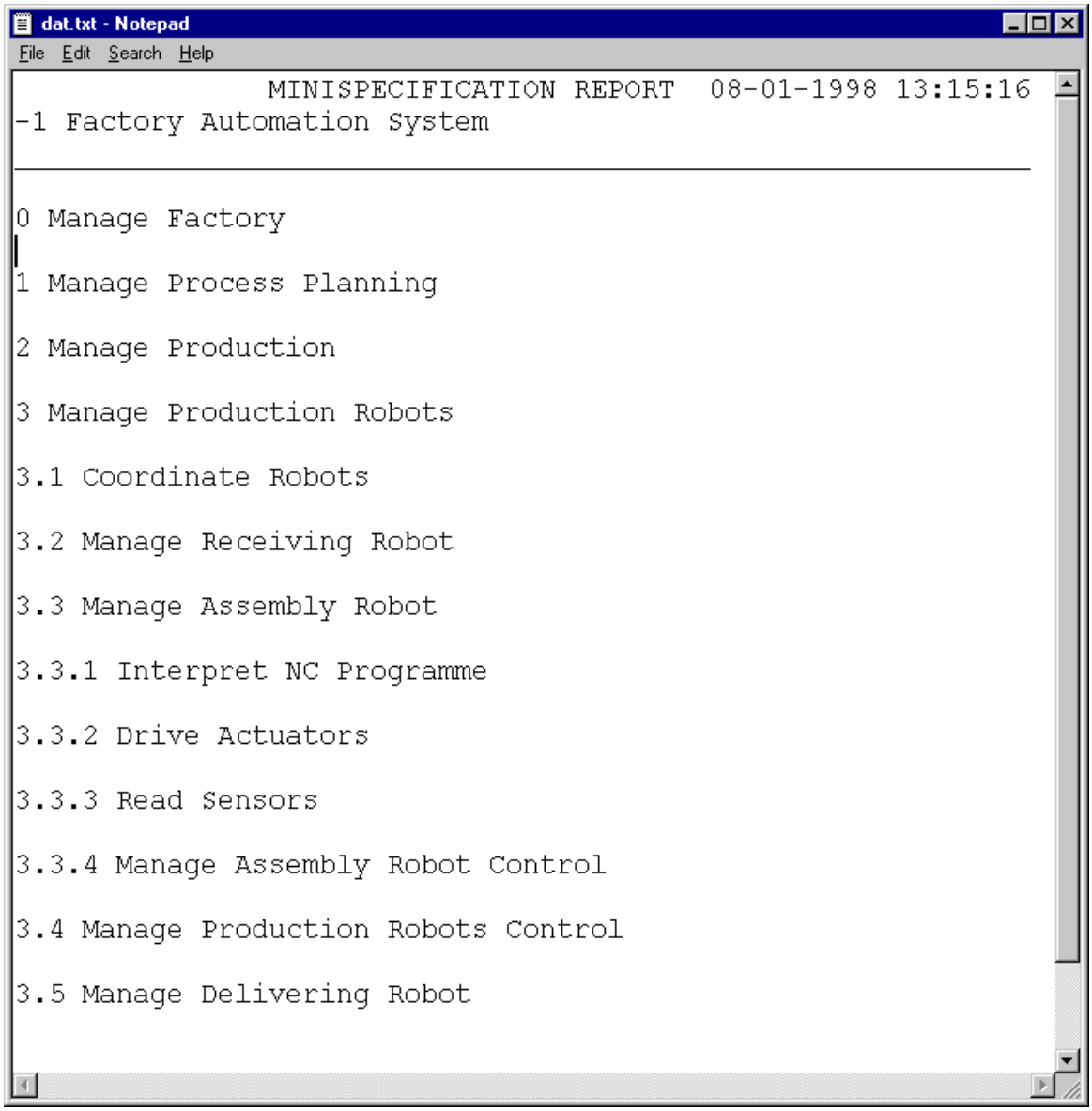

Figure 14.5 Minispecification report (Parameter=MiniSpecification; Options=-ed).

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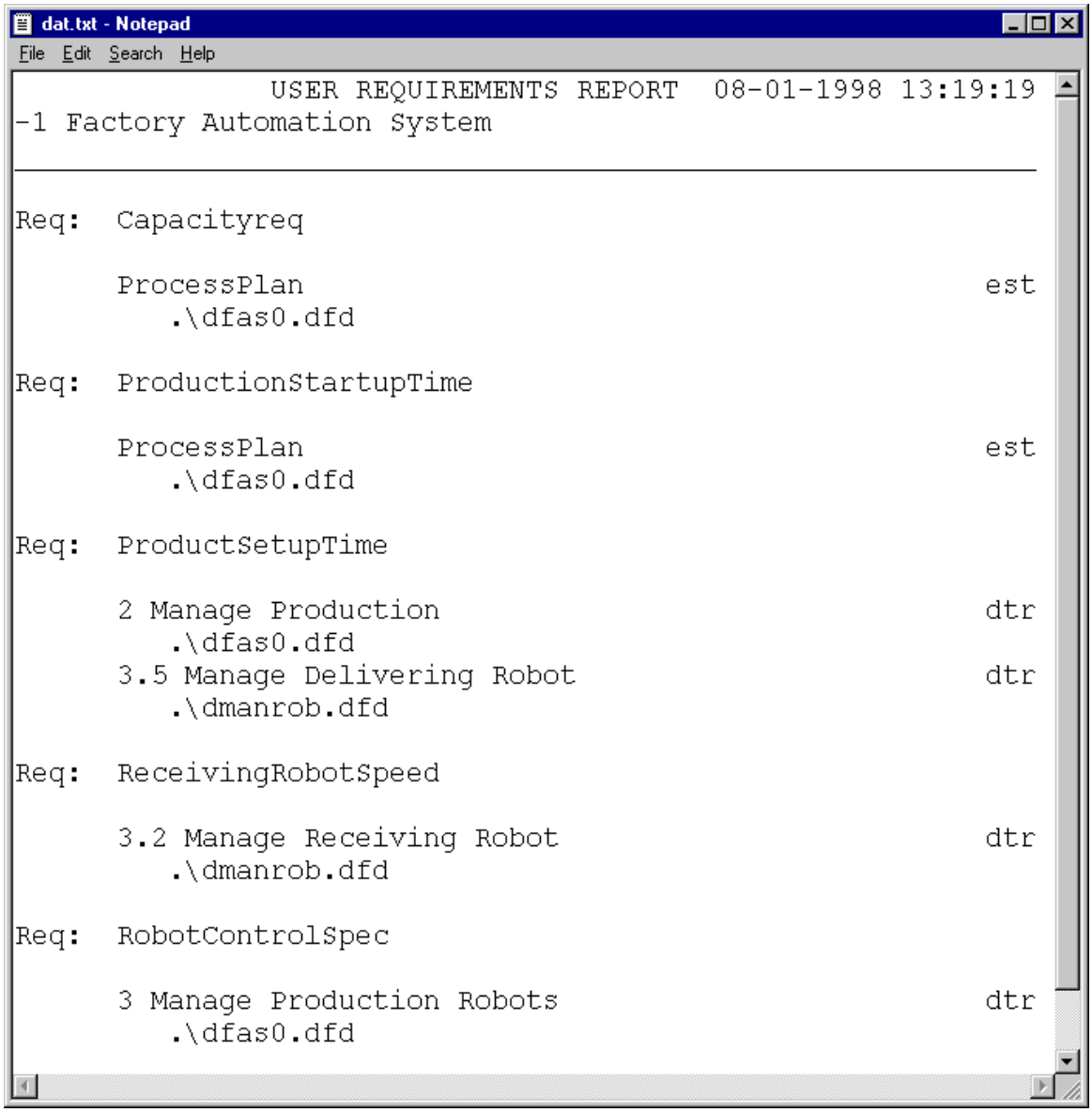

Figure 14.6 User requirements tracing report (Parameter=UserRequirementsTracing; Options=-ed).

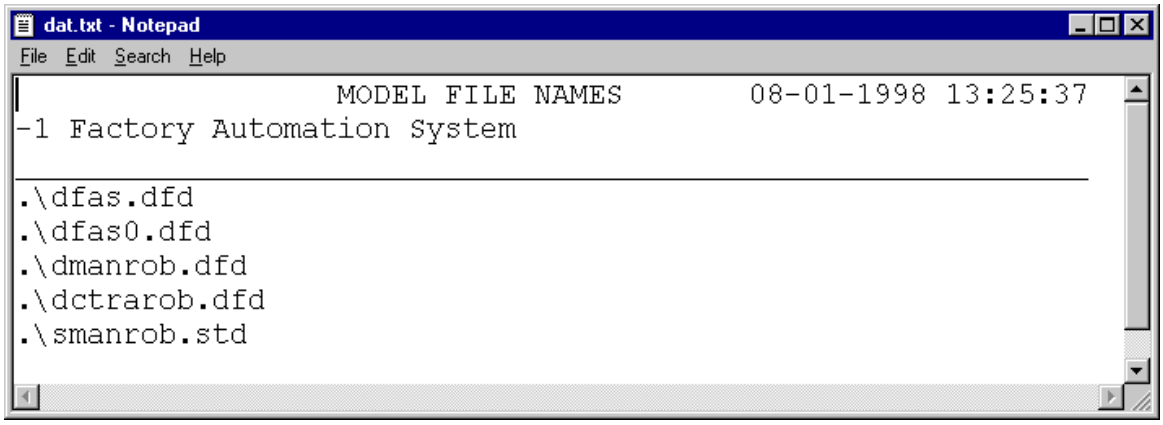

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Figure 14.7 Model names report (Parameter=ProjectModelDatabase; Options=-ed).

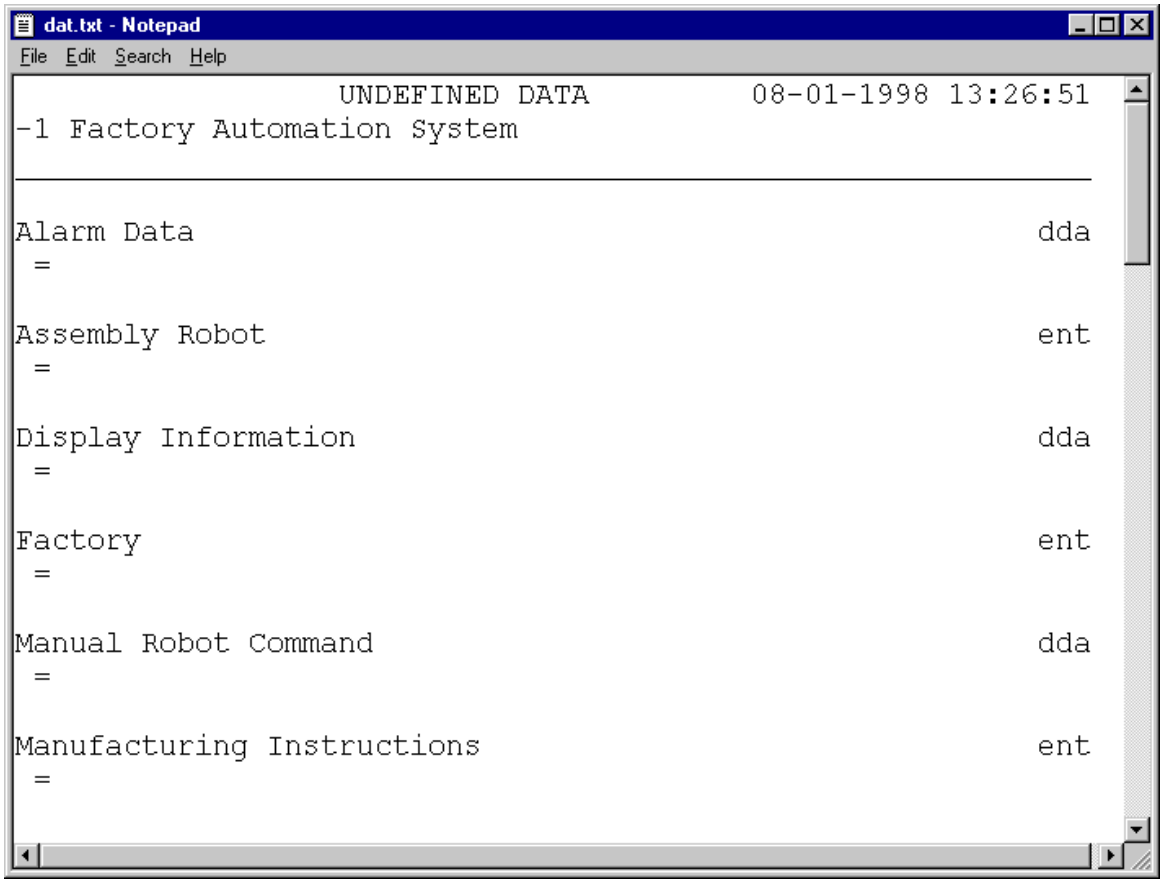

Figure 14.8 Undefined data report (Parameter=UndefinedData; Options=-ed).

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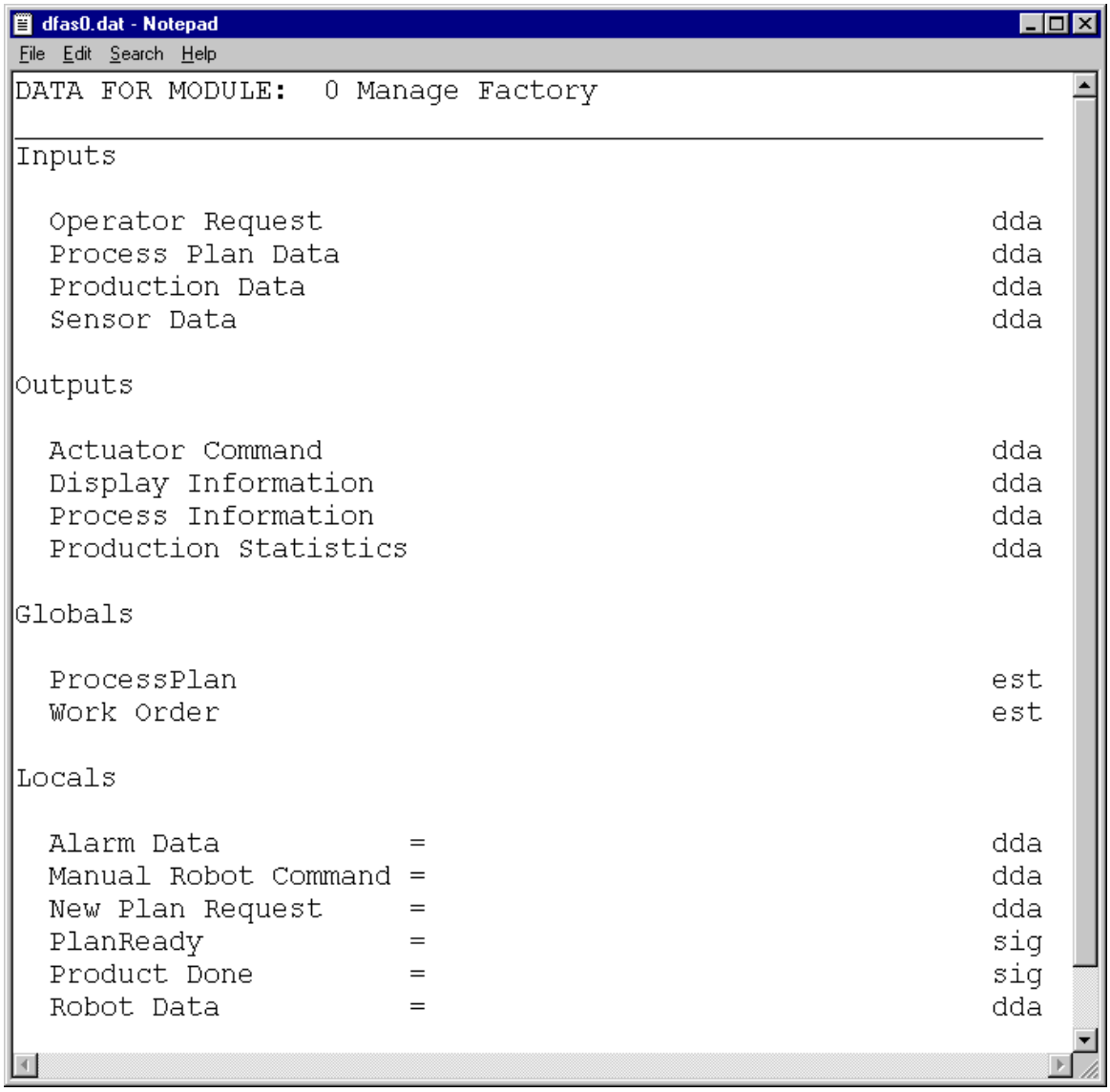

Figure 14.9 Module based data report (Parameter=ModuleBasedData; Options=-dm; Outputfile=*.dat).

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14.7 Requirements tracing report

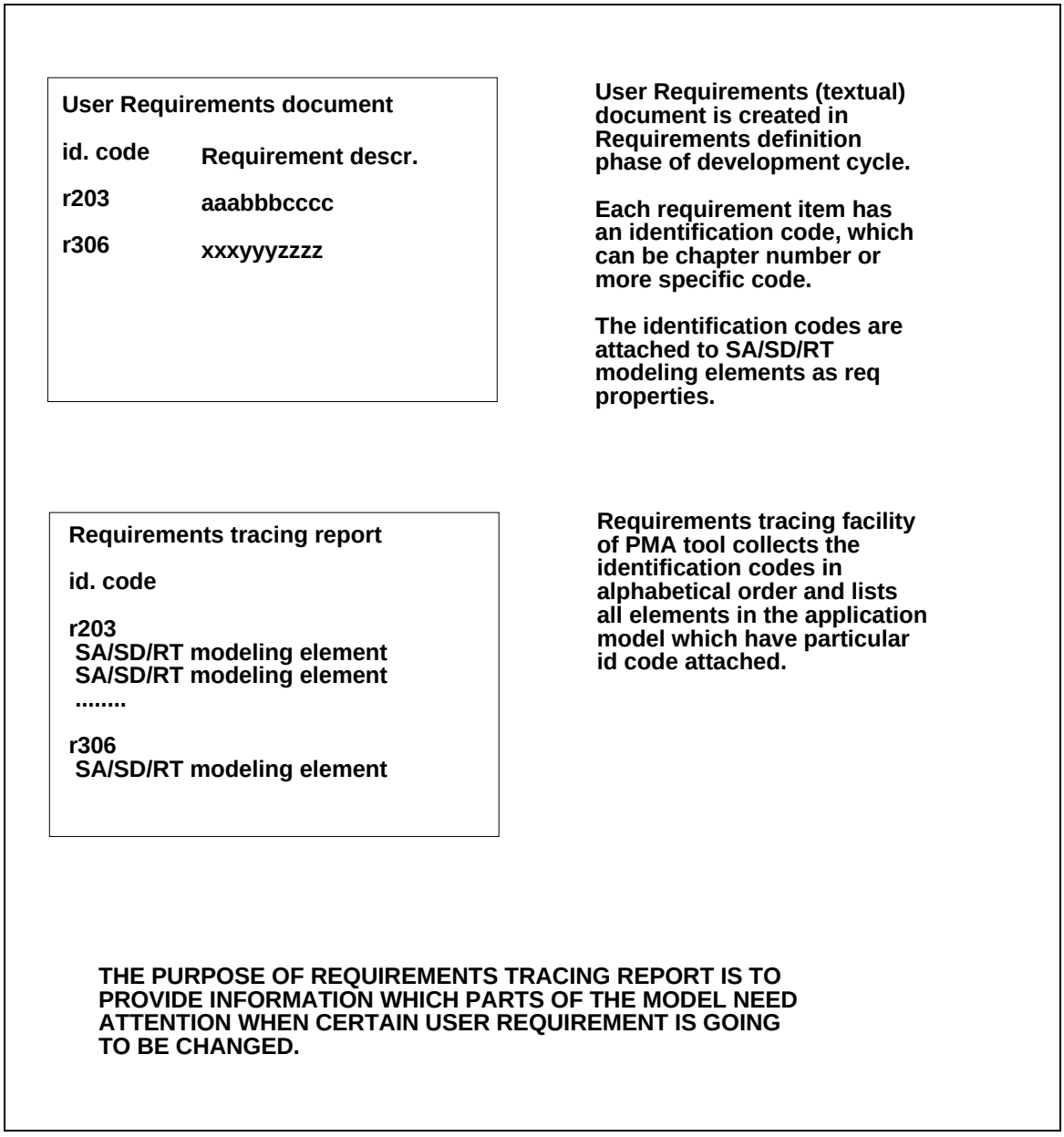
User Requirements document
id. code
Requirement descr.
r203
aaabbbcccc
r306
xxxyyyzzzz
User Requirements (textual) document is created in Requirements definition phase of development cycle.
Each requirement item has an identification code, which can be chapter number or more specific code.
The identification codes are attached to SA/SD/RT modeling elements as req properties.
Requirements tracing report
id. code
r203
SA/SD/RT modeling element
SA/SD/RT modeling element
.....
r306
SA/SD/RT modeling element
Requirements tracing facility of PMA tool collects the identification codes in alphabetical order and lists all elements in the application model which have particular id code attached.
THE PURPOSE OF REQUIREMENTS TRACING REPORT IS TO PROVIDE INFORMATION WHICH PARTS OF THE MODEL NEED ATTENTION WHEN CERTAIN USER REQUIREMENT IS GOING TO BE CHANGED.

Figure 14.10 Principle of requirements tracing.

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Example of user requirements tracing:

1. *Open the data flow diagram **dgate0.dfd**.*
2. *Point Manage Gate Equipment data transformation and open **Property** window.*
3. *Type property name "req", enter tab and type property value "r203"*
   - Manage Gate Equipment data tr has reference to item "r203" in User Requirements Document.
4. *Add requirements reference "r306" to Make Report data transformation.*
5. *Save the diagram **dgate0.dfd**.*
6. *Select **Pop** from workspace menu to enter context diagram.*
   - Answer "Save" to Save/Nosave query.
7. *Select **Req** from **Utilities** menu of Prosa window.*
   - PMA creates requirements tracing report.
8. *Select **Vreq** from **Utilities** menu of Prosa window to view the requirements tracing report.*
9. *Close the text editor.*

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15 MORE GRAPHICS FEATURES

15.1 Copying between Prosa windows

1. *Open the context diagram **dgate.dfd**.*
2. *Select **Set** from **Design** menu of Prosa window.*
3. *Point to the upper-left corner of the imaginary rectangle which wholly encloses data transformation Manage Gate Control and terminators Host Computer and Ticket Reader.*
4. *Click the button.*
5. *Move mouse to the lower-right corner of that rectangle.*
6. *Press and **hold** button down.*
7. *Select **Copy** from the Set submenu.*

   - Prosa copies the contents of the set to Cut & Paste buffer.
8. *Open another Prosa window with **Prosa** selection from **Utilities** menu of Prosa window.*
9. *In the new Prosa window, select **Paste** from the **Model** menu of Prosa window.*
10. *Place the set to the desired position.*
11. *Close the Prosa window.*

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15.2 Comment text

1. *Select **Comment** from the **Design** menu of Prosa window.*
2. *Type comment text (3 lines).*
3. *Place the comment and click.*
4. *Attach the comment by pointing to the beginning and clicking.*
5. *Edit the comment text.*
6. *Place the comment and click.*
7. *New comments are added with **Comment** selection and existing comments are edited by attaching to the beginning of the string and doing the editing.*

15.3 Panning and zooming

15.3.1 Panning

1. *Experience the standard panning with scrollbars.*
2. *Next simultaneous panning in two dimensions is taught.*
3. *Select **Screen** from the workspace menu.*
   *- The inner rectangle called **pan/zoom** rectangle in the centre of Prosa window shows the area which currently is displayed in Prosa window.*
4. *Point to the centre of the pan/zoom rectangle, press and **hold** the button down, and while holding the button down drag the mouse to move the rectangle to different position.*

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5. *Release the button.*
6. *Exit the Screen function by pointing outside the lower-right corner of the pan/zoom rectangle.*
   - Notice the change of area displayed now in Prosa window.

15.3.2 Zooming

1. *Select **Screen** from the workspace menu.*
   *- The inner rectangle called **pan/zoom** rectangle in the centre of Prosa window shows the area which currently is displayed in Prosa window.*
2. *If pan/zoom rectangle is not in the centre of diagram, move it as described above.*
3. *Point to the upper-right corner of the pan/zoom rectangle, press and **hold** the button down, and while holding the button down drag the mouse to resize the rectangle.*
4. *Release the button.*
5. *Exit the Screen function by pointing outside the lower-right corner of the pan/zoom rectangle.*
   - Notice the change of zoom level in Prosa window.
6. *Repeat steps 1-3.*
7. *While changing the size of pan/zoom rectangle, notice how the border of the rectangle is drawn.*
   - Solid line indicates the zoom levels where ratio of graphics and text is correct.

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- Thick solid line indicates the default zoom level which is recommended for all design work.

15.4 Help facility

1. *Experience with **Help** menu.*
2. ***Help Index** selection allows different entry levels to Help system.*

   - The '+' inside the graphic box indicates that more detailed level of information is available by clicking the mouse.
3. *Close the Help window.*
4. ***Getting Started** selection leads you to study small application examples.*

   - See the contents of boxes by clicking inside the box.
5. *Close the Help window.*
6. ***SA/SD Method** selection teaches the principle of the method.*

   - See the contents of boxes by clicking inside the box.
7. *Close the Help window.*
8. ***Using Prosa/sa** selection teaches the principle of Prosa's user interface.*
9. *Close the Help window.*

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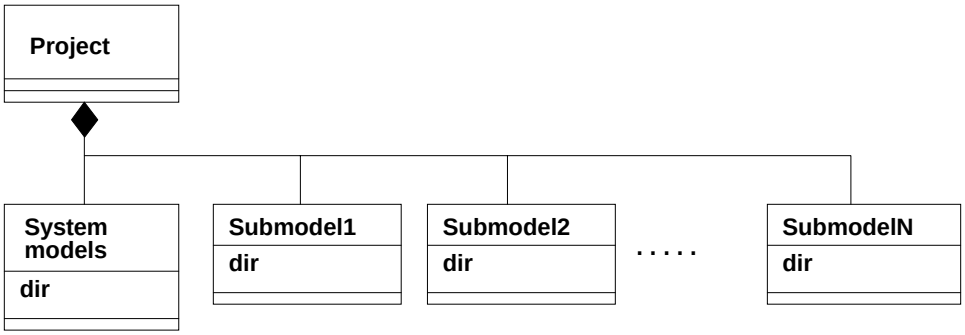
16. PROJECT WORKING ENVIRONMENT

Figure 16.1 shows one alternative to set up project working environment in a networked environment. The arrangement is based on standard file system and is applicable in many network systems in standard configurations.

Commercial configuration management and version control environments can be utilised where Prosa models are managed as standard text documents. Prosa's programmable Utilities menu can have needed insert, retrieve for edit, retrieve for view etc. selections to automate the diagram accessing.



HIGHER LEVEL DIAGRAMS FORM SYSTEM MODEL AND LOCATE IN THEIR OWN DIRECTORY (-IES).

LOWER LEVELS ARE MODELED AS A NUMBER OF SUBMODELS IN THEIR OWN DIRECTORIES.

PROTECTION IS REALIZED IN A DIRECTORY LEVEL OR IN A DIAGRAM LEVEL.

PROJECT SPECIFIC CONFIGURATION FILE PROSA.CFG IS USED TO LIST ALL POSSIBLE SEARCH PATHS FOR THE DIAGRAMS.

PROSA'S SEARCH PATH ALLOWS A DISTRIBUTED MODEL DATA BASE WHERE INDIVIDUAL DIAGRAMS MAY LOCATE ANYWHERE IN THE NETWORK.

Figure 16.1 Principle of modeling project arrangement.

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